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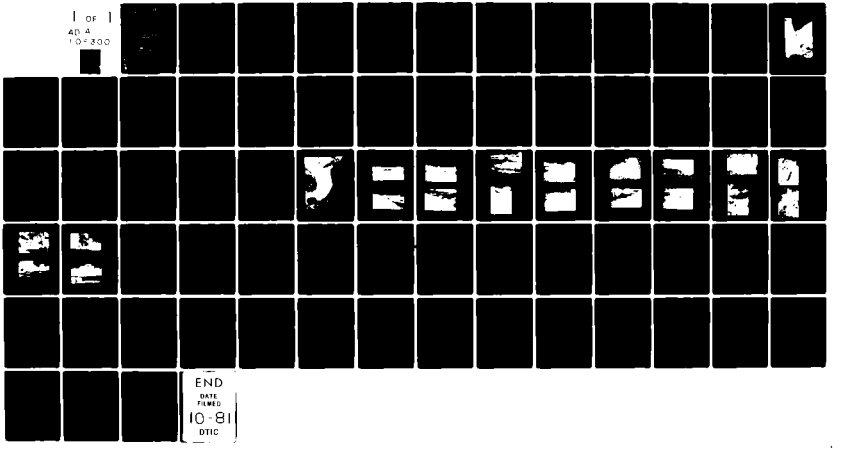

LEVEL II

MISSOURI-NEMAHA-NODAWAY BASIN

KOMER LAKE DAM

BUCHANAN COUNTY, MISSOURI

MO. 10995

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
... Serving the Army
... Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

JUNE, 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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KOMER LAKE DAM
BUCHANAN COUNTY, MISSOURI
MISSOURI INVENTORY NO. MO 10995

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

JUNE, 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Komer Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Komer Lake Dam (Mo. 10995).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

a. Spillway will not pass 50% of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division — 25 SEP 1980 Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 25 SEP 1980 Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Komer Lake Dam
State Located	Missouri
County Located	Buchanan County
Stream	Tributary to Possum Hollow Creek
Date of Inspection	June 3, 1980

Komer Lake Dam was inspected by an interdisciplinary team of engineers, ~~from Hoskins-Western-Sonderegger, Inc.~~ The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Komer Lake Dam has a height of forty-one and one-half (41.5) feet and a storage capacity at the minimum top elevation of the dam of one hundred seventy-five (175±) acre-feet. In accordance with the guidelines, an intermediate size dam has a height greater than or equal to forty (40) feet but less than one hundred (100) feet and a storage capacity greater than or equal to one housand (1,000) acre-feet but less than fifty-thousand (50,000) acre-feet, whichever gives the larger size catagory. Komer Lake Dam is classified as an intermediate size dam.

In accordance with the guidelines and based on visual observation, the dam is classified as having a high potential for damage and loss of life. Failure would threaten life and property. The estimated damage zone extends approximately two (2) miles downstream of the dam. Within the damage zone are three or four houses, two commercial buildings, and Highway FF, all of which are located in Agency.

Our inspection and evaluation indicates that the spillways do not meet the criteria set forth in the recommended guidelines for an intermediate dam having a high hazard potential. The Probable Maximum Flood is the appropriate spillway design flood. The spillways will pass the 100-year flood (1% probability flood - a flood having a one percent chance of being exceeded in any year) without overtopping the dam. The spillways will pass 21% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Design data were not available for this dam. Based on the observations made during the field inspection of the dam, the following remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams:

a. Alternatives.

(1) The spillway size and/or the height of dam should be increased to pass the probable maximum flood without overtopping the dam.

b. Operation and Maintenance Procedures.

(1) Additional information should be obtained on the topographic characteristics of the reservoir area to determine the actual volume of reservoir storage, and a breach routing should be performed to determine downstream damages that would result from failure of the dam. This study should be conducted by a professional engineer experienced in the design and construction of dams.

(2) Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be performed. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) by a professional engineer experienced in the design and construction of dams.

(3) The trees should be removed from the upstream slope and measures taken to prevent their recurrence. Large trees or trees with an extensive system of roots should be removed under the guidance of an engineer experienced in the design and construction of dams.

(4) Measures should be taken to stabilize and control the erosion on the downstream slope and in the abutment troughs.

(5) The sediment in the present conduit in the emergency spillway should be removed and measures taken to keep the spillway open.

(6) A program of regular inspection and maintenance should be initiated with records of the inspections made a part of this project file.

Rey S. Decker
E-3703

Gordon Jamison

Garold Ulmer
E-19246

H. P. Hoskins
Harold P. Hoskins, Chairman of the Board
Hoskins-Western-Sonderegger, Inc.
E-8696

PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
KOMER LAKE DAM - MO 10995
BUCHANAN COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Komer Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D to "Report of the Chief of Engineers on the on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure approximately 483 feet in length and 41.5 feet in height, with a storage capacity of 175 acre-feet at minimum top of dam elevation. This site is located in the dissected till plains area of the Central Lowlands Physiographic Region.

(2) The uncontrolled principal spillway is a seven-inch diameter steel pipe that passes through the embankment at station 4+53±. The inlet end is not equipped with anti-vortex device or trash rack.

(3) The uncontrolled emergency spillway passes through the right abutment and consists of four 22-inch diameter steel barrels laid end to end in the excavated spillway channel and backfilled in order to provide a road crossing of the spillway.

(4) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the central portion of Buchanan County, Missouri, approximately two miles west of Agency as shown on Plate A-2. The dam is shown on Plate A-1 in the SE 1/4 of Section 24, T56N, R35W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Komer Lake Dam has a height of 41.5 feet and a storage capacity of 175 acre-feet. This dam is classified as an intermediate size dam. An intermediate size dam has a height greater than or equal to 40 feet but less than 100 feet and a storage capacity greater than or equal to 1,000 acre-feet but less than 50,000 acre-feet. The size classification is determined by either the storage or height, whichever gives the larger size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.1c above. Based on referenced guidelines and visual observation, this dam is in the High Hazard Classification. The estimated damage zone extends for about 2 miles downstream of the dam. Within the damage zone are three or four houses, two commercial buildings and Highway FF all of which are located in Agency.

e. Ownership. The dam is owned by Harry Komer, Route 1, Agency, Missouri 64401.

f. Purpose of Dam. Mr. Komer stated that the dam was constructed to serve as an access road from his farmstead located to the north of the dam to his cultivated land located to the south of the dam (see Photo No. 1-overview).

g. Design and Construction History. No design or construction data was available for this dam. Mr. Komer reported that the dam, as it exists now, was constructed in 1977 by raising the elevation of an older dam by approximately 10 feet. Construction was done by John Ussary of Agency, Missouri.

h. Normal Operating Procedures. There are no controlled outlets for this dam. The pool level is controlled by rainfall, infiltration, evaporation and the capacity of the uncontrolled spillways.

1.3 PERTINENT DATA

a. Drainage Area. 88.2 acres (0.138 square miles).

b. Discharge at Damsite.

(1) All discharges at the damsite are through the following:

(a) An uncontrolled 7-inch steel pipe conduit principal spillway.

(b) An uncontrolled excavated earth emergency spillway which is equipped with a 22-inch diameter steel pipe (barrel) culvert centered on tha axis of the dam in order to provide a road crossing of the spillway.

(2) Estimated maximum flood at damsite -- unknown.

(3) The principal spillway capacity varies from 0 c.f.s. at elevation 979.7 feet to 4 c.f.s. at the crest of the emergency spillway (elevation 983.1 feet) to 4 c.f.s. at the minimum op of dam (elevation 983.9 feet).

(4) The emergency spillway capacity varies from 0 c.f.s. at its crest (elevation 983.1 feet) to 8 c.f.s. at the minimum top of dam (elevation 983.9 feet).

(5) Total spillway capacity at the minimum top of dam is 12 c.f.s. ±.

c. Elevations (feet above M.S.L.).

(1) Observed pool - 980.0

(2) Normal pool - 979.7

(3) Spillway crest (s)

Principal - 979.7

Emergency - 983.1

(4) Maximum experienced pool - unknown

(5) Top of dam (minimum) - 983.9

(6) Streambed - 942.4 ±

(7) Maximum Tailwater - unknown

d. Reservoir. Length (feet) of pool

(1) At principal spillway crest - 900±

(2) At emergency spillway crest - 1000±

(3) At top of dam (minimum) - 1050±

e. Storage (Acre-feet).

(1) Observed pool - 133±

(2) Normal pool - 133±

(3) Spillway crest (s)

Principal - 133±

Emergency - 165±

(4) Maximum experienced pool - unknown

(5) Top of dam (minimum) - 175±

f. Reservoir Surface (Acres).

(1) Observed pool - 10 ±

(2) Normal pool - 10 ±

(3) Spillway crest (s).

Principal - 10 ±

Emergency - 11 ±

(4) Maximum experienced pool - unknown

(5) Top of dam (minimum) - 12 ±

g. Dam.

(1) Type - Earth fill

(2) Length - 483 feet ±

(3) Height - 41.5 ft. ±

(4) Top Width - 12 ft. ±

(5) Side slopes.

(a) Downstream - 1V on 2.2 H

(b) Upstream - 1V on 2.8 H

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

(10) Wave protection - None

(11) Drains - unknown

h. Diversion Channel and Regulating Tunnel. None

i. Spillways.

(1) Principal

(a) Type - Uncontrolled 7-inch diameter steel pipe.

(b) Crest (invert) elevation - 979.7

Outlet - 944.5

(c) Length - 156 feet

(2) Emergency

(a) Type - An uncontrolled excavated earth spillway which is equipped with a 22-inch diameter steel pipe (barrel) culvert centered on the axis of the dam in order to provide a road crossing of the spillway.

(b) Control section - Control is the high point of the excavated channel approximately 25-feet downstream from the outlet end of the 22-inch diameter barrel culvert. Elevation at control is approximately one foot higher than the outlet end of the culvert which has resulted in backflow from the control to the reservoir and deposition of silt in the culvert.

(c) Crest elevation - 983.1 ± (earth channel)

- 982.1 ± (culvert invert)

(d) Upstream Channel - Open with sparse to no vegetative cover and set at 7% ± grade from reservoir up to inlet end of culvert.

(e) Downstream Channel - Open with erosion occurring in right bank and sparse to good vegetative cover. Grade from the control to exit into headcut leading to old channel averages 1.5% ±.

j. Regulating Outlets. None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data was available. It was reported by Mr. Harry Komer that there was an old dam at this site. The dam was raised approximately 10 feet in 1977. Construction was done by John Ussary of Agency, Missouri.

2.3 OPERATION

No data were available on spillway operation.

2.4 EVALUATION

a. Availability. No data were available.

b. Adequacy. The field surveys and visual observation presented herein are considered adequate to support the conclusion of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Komer Lake Dam was made on June 3, 1980. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: R.S. Decker, Geotechnical, Garold Ulmer and Gordon Jamison, Hydrology and Hydraulics. Mr. Komer was interviewed on the day of the inspection but was not present during the inspection.

b. Dam.

(1) Geology and Soils (abutment and embankment). Komer Lake Dam is located in the dissected till plains area within the Central Lowlands Physiographic Region. The dam site is in a region where the stratagraphic sequence consists of loess overlying Kansan-age glacial till which in turn overlies bedrock. Bedrock at this site consists of strata assigned to the Kansas City Group, Missourian Series, Pennsylvanian System. Strata of this group are comprised of interlayered sequences of shale, sandstone and limestone.

Abutments consist of loess and loessial colluvium overlying glacial drift. Gravelly glacial drift-like materials are exposed at the base of the right abutment adjacent to the pipe spillway outlet. Bedrock was not exposed in the dam site area. Alluvial (CL-ML) thickness downstream of the dam is 5 to 10 feet thick.

Materials in the dam are silty loess (CL-ML). The soil deposits in the dam area consist of upland soils of the Sharpsburg-Grundy-Adair-Shelby soil association. This soil association is common in a landscape in which moderately deep loess overlies glacial till.

(2) Upstream Slope. The upstream slope is fairly well vegetated with grass and small willows. No slumping or significant erosion was noted on the upstream slope. Photo No. 4 shows the upstream slope.

(3) Crest. The crest is sparsely vegetated and serves as a dam road. Measurements indicate that the crest elevations are relatively uniform with a slightly lower area toward the right end of the dam (See Plate C-1). No cracks or slumps were noted on the crest. Photos 3 and 6 show the crest.

(4) Downstream Slope. The downstream slope is fairly well vegetated with grass and weeds as shown in Photos 6 and 9. Considerable erosion was noted on the slope as shown in Photo 13. No cracks, slides or slumps were evident on the slope. Gully erosion and headcutting were observed in both abutment troughs as shown in Photos 5 and 9. Seepage outcrops in both abutment troughs and along the toe of the dam. Seepage in the left abutment trough outcrops at about elevation 976, about 4 feet lower than the reservoir level. Seep in the right abutment trough outcrops at about elevation 955, some 10 feet above the valley floor. Seepage is through gravelly, till-like material. All seepage is clear, and there were no indications of boils. The total seepage discharge is estimated at less than 1 g.p.m. Seepage discharges are shown in Photos 14, 17 and 18.

(5) Miscellaneous. The nature of the vegetative cover and the materials exposed on the dam would indicate that overtopping of this structure would cause serious damage and probable failure.

c. Appurtenant Structures.

(1) The principal spillway consists of a 7-inch diameter steel pipe without trash rack or antivortex device on the inlet. The pipe passes through the upper section of the embankment. 35 to 40 feet of the outlet end are exposed to the surface. The pipe appears to be in good condition. Photos 10 and 15 show the pipe spillway.

(2) The emergency spillway is located on the right abutment and consists of a 22-inch conduit formed from open-end steel oil barrels. The barrel conduit passes under the roadway crossing the dam. The outlet channel for the spillway is a sparsely vegetated excavated channel with a 13 foot bottom width and 1 on 4 side slopes. Measurements indicate that the outlet channel is higher than the invert elevation of the barrel conduit for a distance of about 100 feet downstream from the conduit. The water level behind the dam will rise to within eight-tenths (0.8) of a foot of the low point on the crest of the dam before flow will pass the high point in the spillway outlet channel. The outlet end of the barrel is silted in as a result of reverse flow of surface water from the outlet channel back into the reservoir. The outlet channel discharges into a gully and headcut about 175 feet downstream from the dam. Photos 6, 7 and 8 show the emergency spillway.

(3) Drawdown Facility. There is no drawdown facility for this dam.

d. Reservoir Area. The reservoir area is fairly well vegetated around the water line. No slumps, slides or severely eroded areas were observed around the shoreline. Photo 11 shows a portion of the reservoir.

e. Downstream Channel. The channel downstream from the pipe spillway is badly clogged with trees and brush. However, this growth should not interfere with discharges from this small pipe spillway. Photo 12 shows the valley downstream from the pipe spillway.

3.2 EVALUATION

This structure is only in fair condition with a serious potential of failure if it ever overtopped. Gully erosion in both abutment troughs and erosion on the downstream slope could cause breaching and failure if accelerated by overflow. Failure from shear slides or excess seepage pressures are not likely since the present reservoir level is within 4 feet of the top of dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. The pool level is controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

There doesn't appear to be any regular maintenance on this dam. Erosion on the downstream slope and abutment troughs is uncontrolled. Vegetative cover is not too good. The emergency spillway outlet is higher than the conduit invert, and the conduit is partially plugged with sediment so that the spillway cannot operate effectively. Willow trees are growing on the upstream slope.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

The lack of regular maintenance of this dam is evident. No measures have been taken to control the erosion of the downstream slope and the abutment troughs. Overtopping would accelerate the present erosion on the downstream slope and in the abutment troughs and would impose a definite threat of breaching the reservoir.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS St. Joseph South, MO.-KANS., 7 1/2 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The principal spillway pipe is open end without a hood. It is not known if pipe has a bend near the outlet.

(2) The downstream end of the barrel-culvert of the emergency spillway is partially full of mud. The low point of the earthen spillway channel 25 feet downstream from the barrel-culvert outlet is approximately one foot higher than the barrel-culvert invert. To get maximum use of the culvert, the channel downstream should be excavated to an equal or lower elevation than the culvert invert.

d. Overtopping Potential. The spillways are too small to pass the probable maximum flood without overtopping. The spillways will pass 21% of the PMF and the one percent probabilistic flood without overtopping. Overtopping is dangerous because the flow of water over the crest will erode the face of the dam and, if continued long enough, will breach the dam with sudden release of all of the impounded water into the downstream floodplain.

The results of the routings through the dam are tabulated in regards to the following conditions.

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	*Maximum Depth Over Dam Feet	Duration Over Top Hours
1%	390	4	982.6	1.3	--
1/2 PMF	770	640	985.0	1.1	9
PMF	1540	1420	985.4	1.5	11
0.21 PMF	320	12	983.9	0	--

*Minimum Top of Dam Elevation - 983.9

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and an intermediate size. Therefore, the PMF is the test for the adequacy of the dam and its spillways.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. This dam appears to be structurally stable from the standpoint of shear strength and seepage pressures. There are no observable slides or slumps, and all seepage is clear with no indications of boils. The erosional stability of the dam is not known but it would appear that overtopping would cause severe damage and probable breaching of the reservoir.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Operating Records. There are no controlled operating facilities for this dam.

d. Post Construction Changes. The dam as it exists now was constructed in 1977. Mr. Komer stated that an older dam (date of construction not known) existed at the site and that it was raised approximately 10 feet in height.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of the magnitude predicted in this area is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. This dam is only in fair condition. According to the approximate analyses presented in this report, the dam is not hydrologically adequate. It will impound the 100 year flood, but the flood from the Probable Maximum Flood will overtop the dam by 1.5 feet for about 11 hours. Such overtopping would undoubtedly accelerate the gully erosion in both abutment troughs and on the downstream slope of the dam and could result in breaching the reservoir. Tree growth on the upstream slope should be removed and controlled. The emergency spillway is not hydraulically efficient. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the guidelines were not available which is considered a deficiency.

c. Urgency. A program should be developed as soon as possible to monitor at regular intervals the deficiencies described in this report. The remedial measure recommended in paragraph 7.2 should be accomplished in the near future. The item recommended in paragraph 7.2.a should be pursued on a high priority basis.

d. Necessity for Further Investigation. Prior to implementing the recommendation presented in paragraph 7.2a, additional information should be obtained by the owner on the topographic characteristics of the reservoir area to determine the actual volume of reservoir storage, and a breach routing should be performed to determine downstream damages that would result form failure of the dam.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam. It is recommended, however, that the prescribed seismic loading for Seismic Zone 1 be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance

of a registered professional engineer experienced in the design and construction of earth dams.

a. Alternatives.

(1) The spillway size and/or the height of dam should be increased to pass the probable maximum flood without overtopping the dam.

b. Operation and Maintenance Procedures.

(1) Additional information should be obtained on the topographic characteristics of the reservoir area to determine the actual volume of reservoir storage, and a breach routing should be performed to determine downstream damages that would result from failure of the dam. This study should be conducted by a professional engineer experienced in the design and construction of dams.

(2) Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" should be performed. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) by a professional engineer experienced in the design and construction of dams.

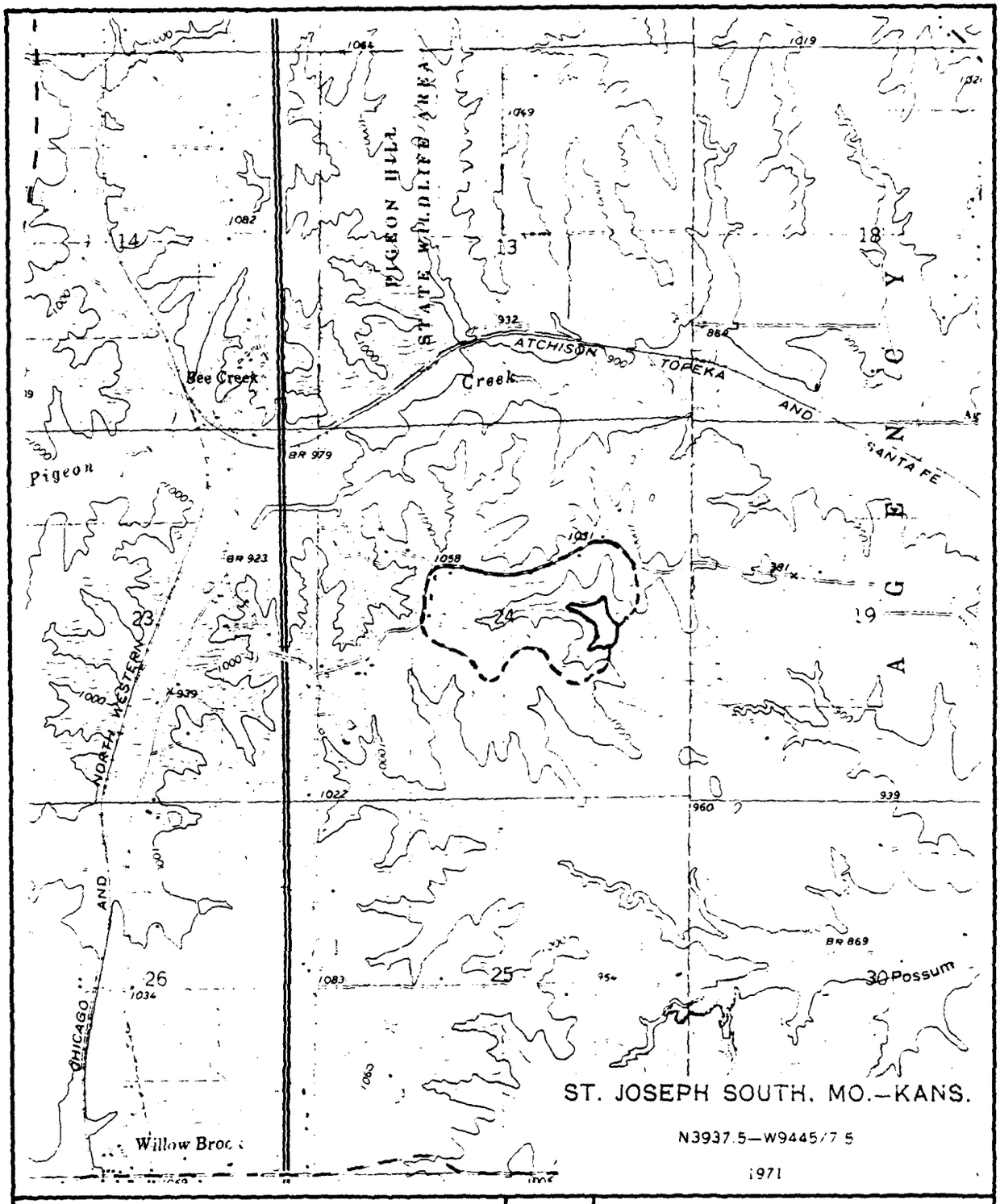
(3) The trees should be removed from the upstream slope and measures taken to prevent their recurrence. Large trees or trees with an extensive system of roots should be removed under the guidance of an engineer experienced in the design and construction of dams.

(4) Measures should be taken to stabilize and control the erosion on the downstream slope and in the abutment troughs.

(5) The sediment in the present conduit in the emergency spillway should be removed and measures taken to keep the spillway open.

(6) A program of regular inspection and maintenace should be initiated with records of the inspections made a part of this project file.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval – 20'

N

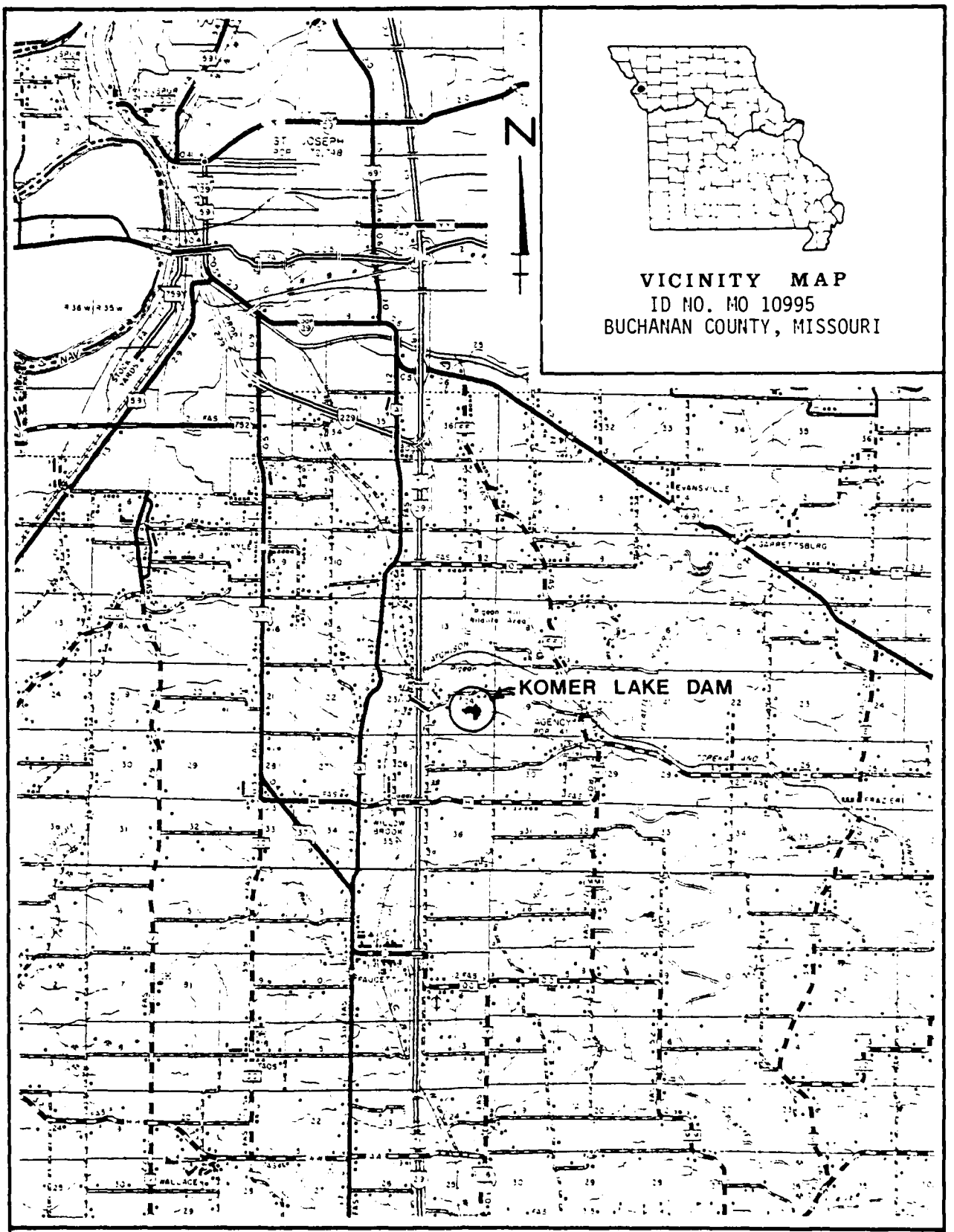
VICINITY TOPOGRAPHY

KOMER LAKE DAM

BUCHANAN COUNTY, MISSOURI

MO. 10995

PLATE A-1



LOCATION MAP

PLATE A-2

APPENDIX B
PHOTOGRAPHS

KOMER LAKE DAM
BUCHANAN COUNTY, MISSOURI
MO 10995

PHOTO INDEX

PLATE B-1

PHOTO NO. 2 - OVERVIEW. DAM IN LEFT CENTER.

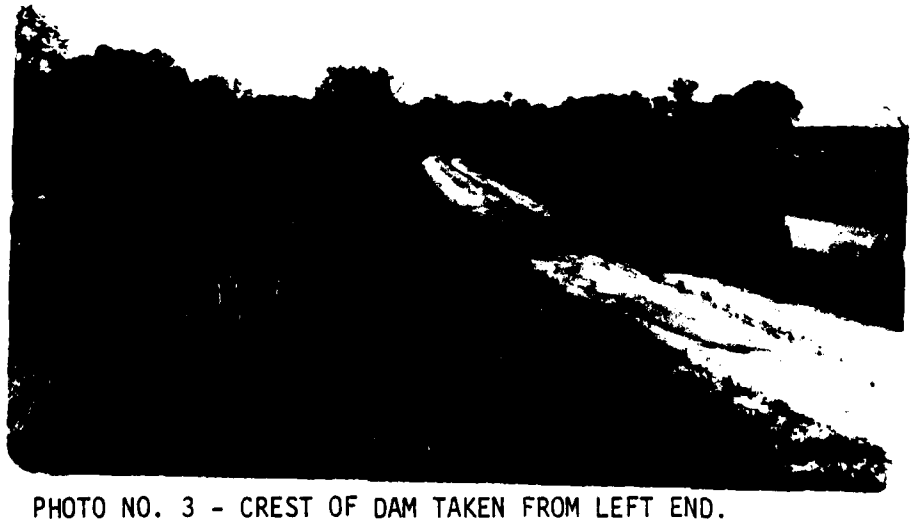


PHOTO NO. 3 - CREST OF DAM TAKEN FROM LEFT END.

PHOTO NO. 4 - UPSTREAM SLOPE FROM LEFT END.

PHOTO NO. 5 - EROSION IN LEFT ABUTMENT TROUGH.

PHOTO NO. 6 - CREST OF DAM TAKEN FROM RIGHT END. FOOT ON TOP OF BARREL EMERGENCY SPILLWAY.

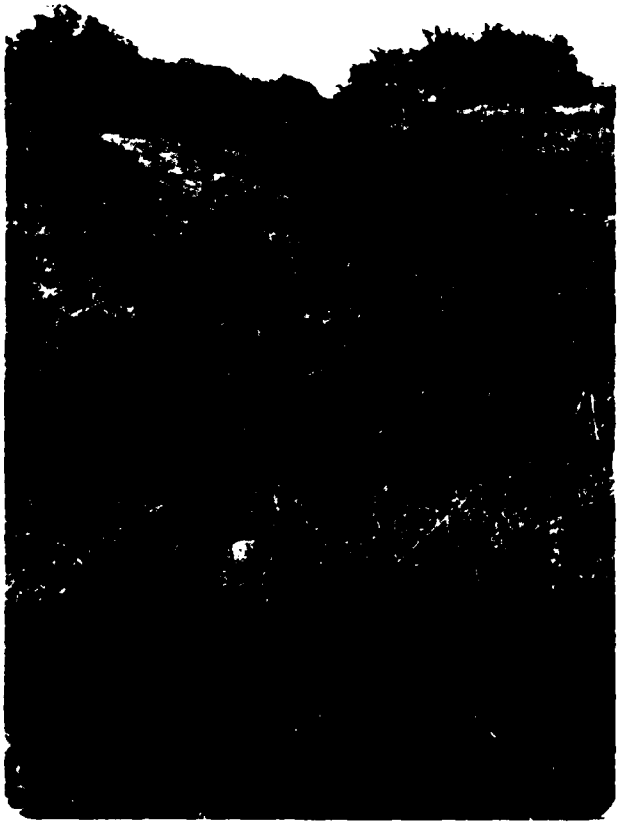


PHOTO NO. 7 - VIEW DOWNSTREAM IN EMERGENCY SPILLWAY CHANNEL. AUGER AT END OF PIPE (BARREL) CONDUIT.

PHOTO NO. 8 - ENTRANCE TO PIPE (BARREL) EMERGENCY SPILLWAY.

PHOTO NO. 9 - DOWNSTREAM SLOPE FROM EMERGENCY SPILLWAY. EROSION IN RIGHT ABUTMENT TROUGH.

PHOTO NO. 10 - PRINCIPAL SPILLWAY PIPE. INLET END.

PHOTO NO. 11 - VIEW UPSTREAM TAKEN FROM PRINCIPAL SPILLWAY LOCATION.

PHOTO NO. 12 - VIEW DOWNSTREAM TAKEN FROM PRINCIPAL SPILLWAY LOCATION.

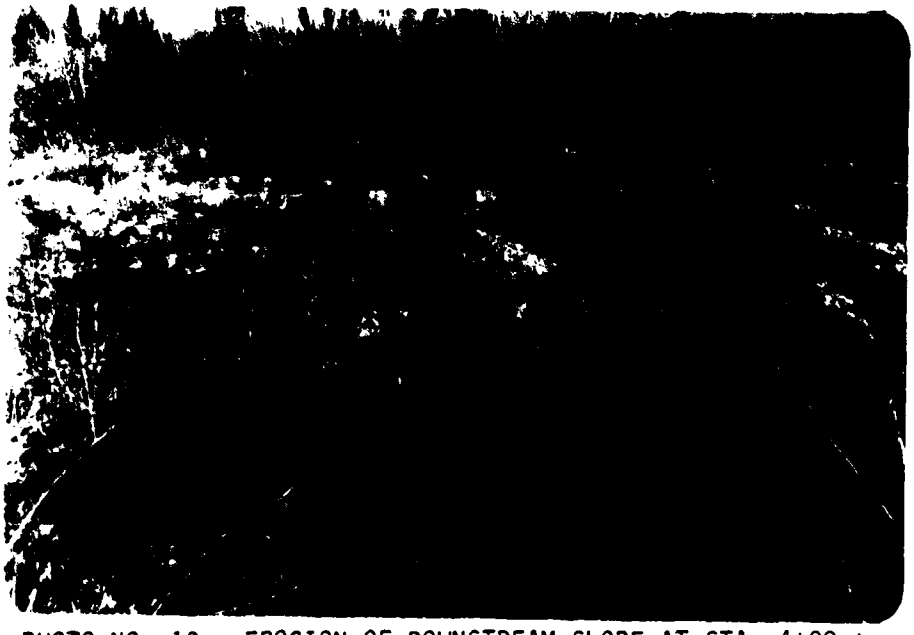


PHOTO NO. 13 - EROSION OF DOWNSTREAM SLOPE AT STA. 4+00 ± .

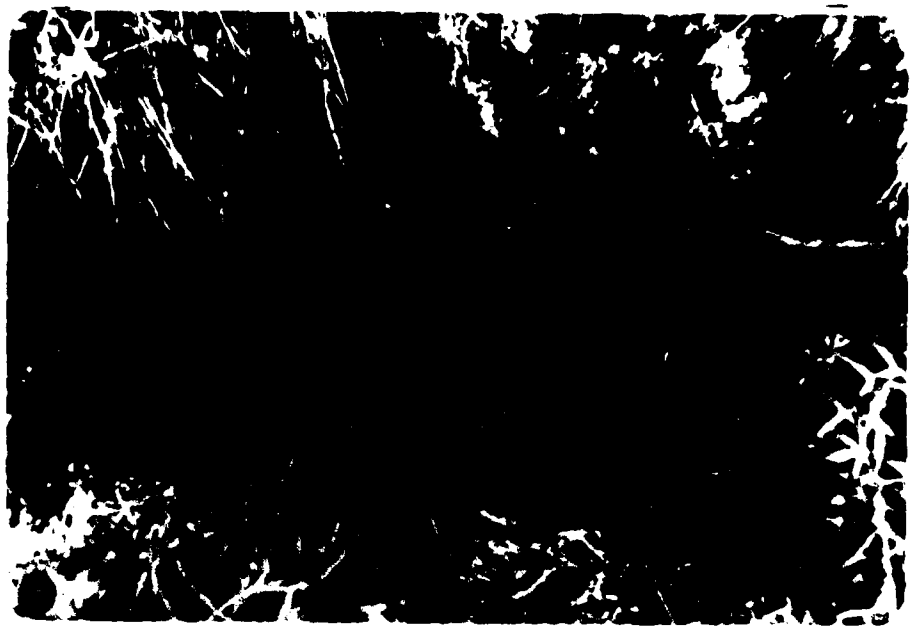


PHOTO NO. 14 - SEEPAGE IN RIGHT ABUTMENT TROUGH

PHOTO NO. 15 - OUTLET END OF PRINCIPAL SPILLWAY.

PHOTO NO. 16 - SEEPAGE DISCHARGE FROM RIGHT ABUTMENT.

PHOTO NO. 17 - SEEPAGE FROM TOE OF DAM AND LEFT ABUTMENT. PICTURE TAKEN FROM END OF PRINCIPAL SPILLWAY LOOKING NORTH ALONG TOE.

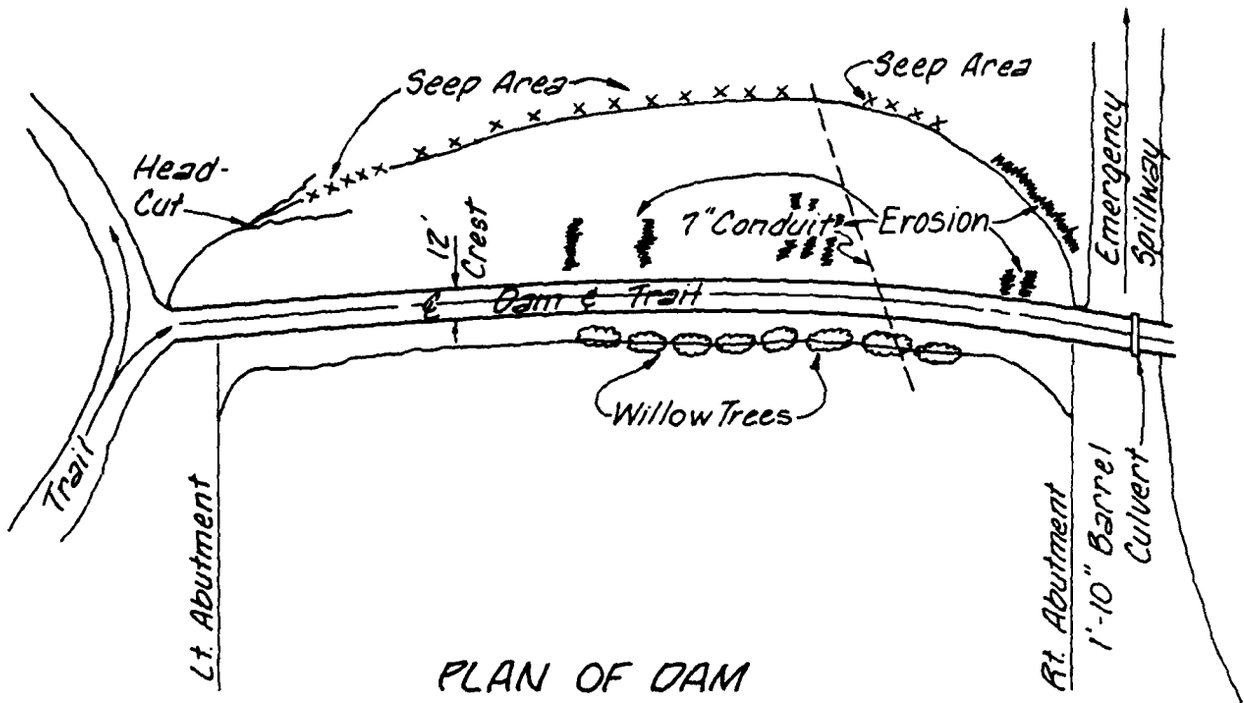
PHOTO NO. 18 - DOWNSTREAM CHANNEL FROM TOE OF DAM.

PHOTO NO. 19 - SERVICE STATION AT AGENCY SHOWING STAFF GAUGE ON LIGHT POLE.

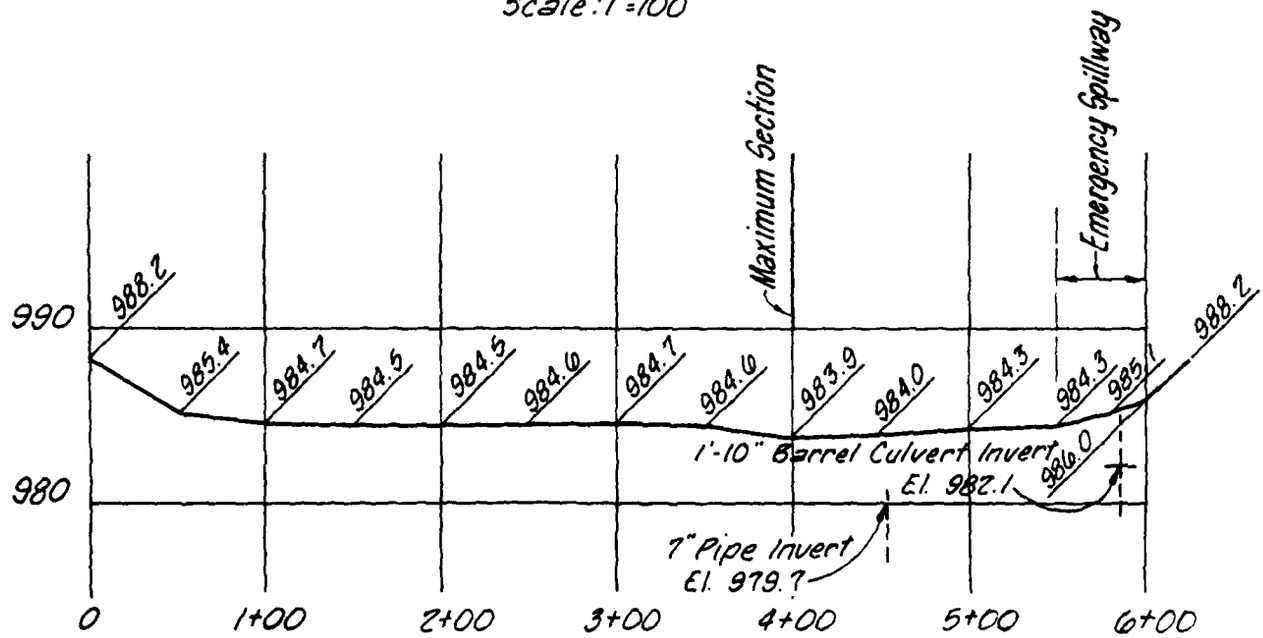
PHOTO NO. 20 - BUILDING IN AGENCY. NOTE HIGH WATER MARKS. HIGH WATER MARKS RESULT FROM FLOODS ON THE PLATTE RIVER NOT THE USSARY AND KOMER TRIBS.

PHOTO NO. 21 - HOUSES ON WEST EDGE OF AGENCY.

APPENDIX C
PROJECT PLATES

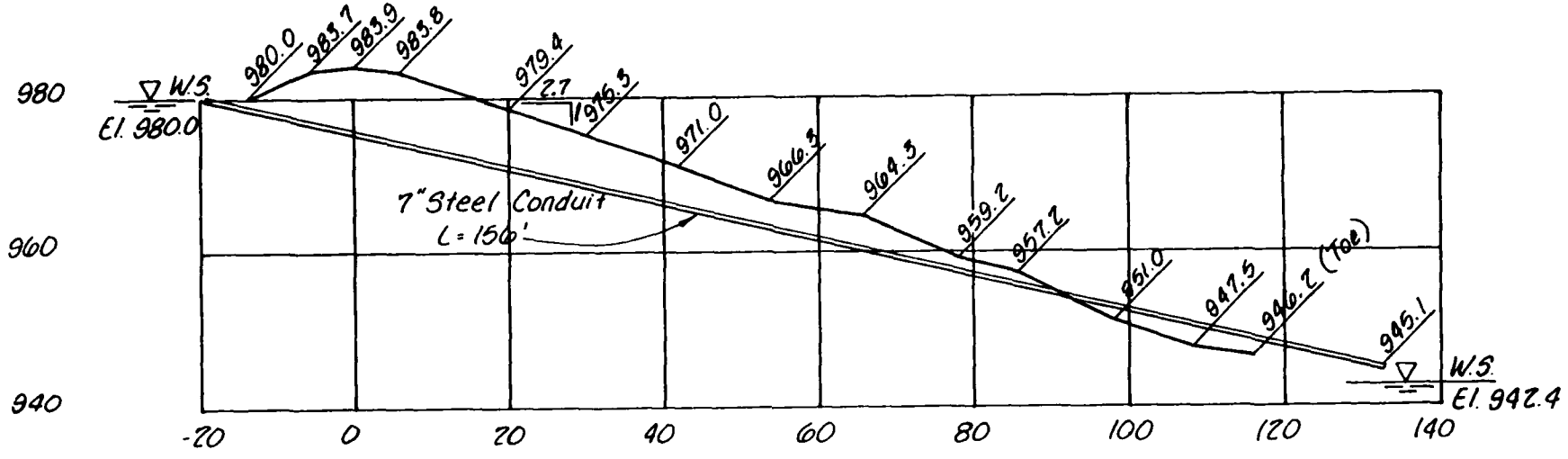


PLAN OF DAM
Scale: 1"=100'



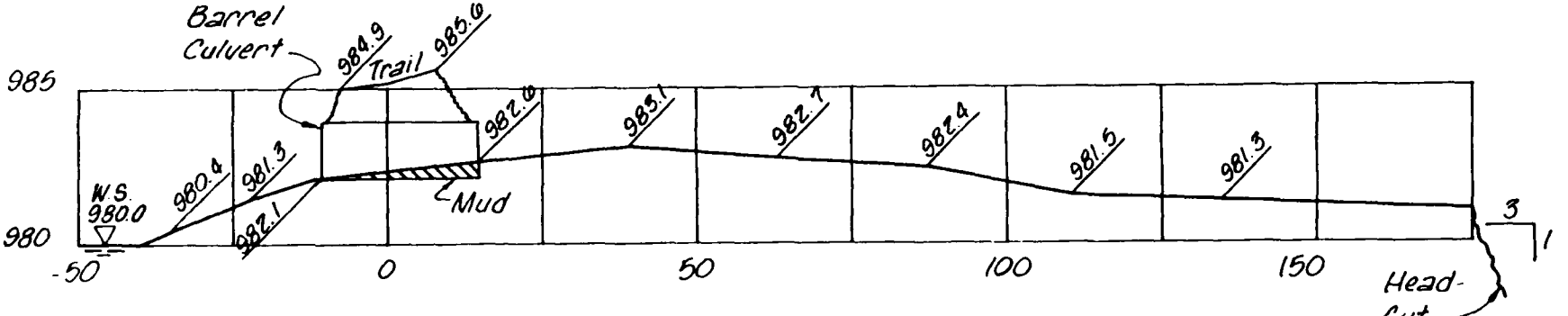
PROFILE ALONG CENTERLINE OF DAM
Scale: 1"=100' H.
1'=10' V.

PLATE C-1



MAXIMUM CROSS-SECTION OF DAM AT STA 4+00

Scale: 1"=20'



PROFILE ALONG CENTERLINE OF EMERGENCY SPILLWAY

Scale: 1" = 25' H.
1" = 5' V.

PLATE C-2

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See this Section).

   a. Twenty-four hour, one percent probabilistic rainfall for the dam location was taken from the data for the rainfall station at Kansas City, MO. as supplied by the St. Louis District, Corps of Engineers per their letter dated 4 March 1980. The twenty-four hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.138 square miles (88.2 acres).

   c. Time of concentration of runoff = 16 minutes (computed from the SCS "Upland" method; compared to 12.5 minutes by Kirpich formula).

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the one percent probabilistic precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the invert of the principal spillway.

   e. The total twenty-four hour storm duration losses for the one percent probabilistic storm were 3.03 inches. The total losses for the PMF storm were 1.58 inches. These data are based on SCS runoff curve No. 74 and No. 88 for antecedent moisture conditions SCS AMC II and AMC III respectively. The watershed is composed of primarily SCS soil group B (Knox-Judson-McPaul association). About 53% of the area is under cultivation for row crops, small grain, or legumes and partial contoured or terraced; about 31% is pasture and woods; and the remainder is farmsteads and ponds.

   f. Average soil loss rates = 0.05 inch per hour approximately (For PMF storm, AMC III).

2. The combined discharge rating consisted of three components: the flow through the principal spillway (negligible), the flow through the emergency spillway and the flow going over the top of the dam and the road across the spillway channel.

a. The principal spillway rating was developed by using the weir and full conduit flow equations described in the SCS Tech. Rel. No. 3 "Hood Inlets for Culvert Spillways" using:

pipe dia = 7 inches
pipe length = 156 ft.
n = .012
A = .267
K_p = .0565

The weir flow was based on Table I of T.R. No. 3.

b. The emergency spillway rating curve was developed using a combination of the following:

(1) Culvert flow from FHA-BPR-HEC No. 5.

(2) Channel flow from Corps of Engineers, Water Surface Profile HEC-2 computer program.

(3) Flow over road using methods and coefficients found in USGS TWRI, Bk 3, Ch. A-5.

c. The flows over the dam were determined by using the dam overtopping analyses (irregular top of dam) within the HEC-1 (Dam Safety Version) program.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The input, output and plotted hydrographs are attached in this Section.

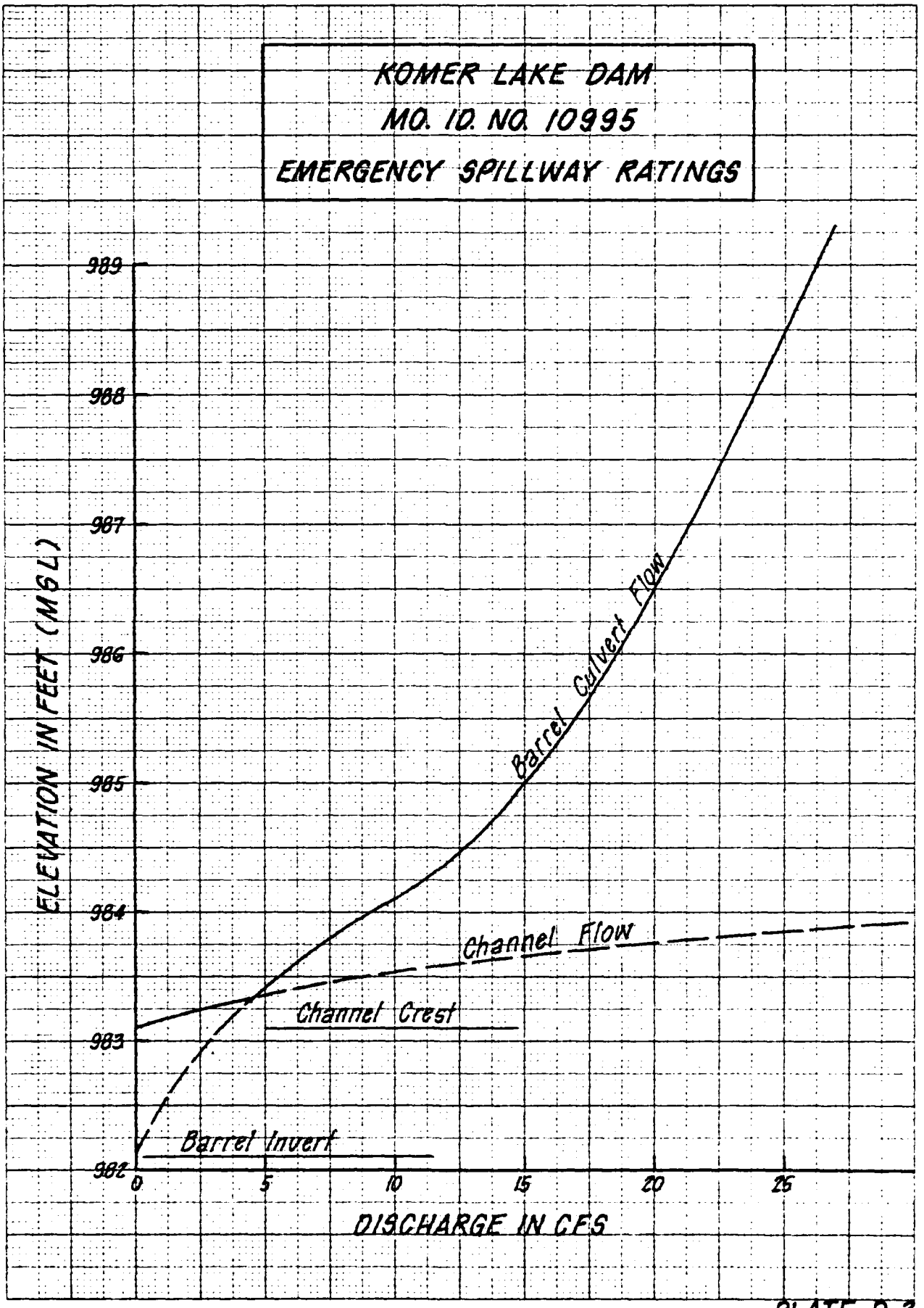

KOMER LAKE DAM
MO. ID. NO. 10995
EMERGENCY SPILLWAY RATINGS
ELEVATION IN FEET (MSL)
989
988
987
986
985
984
983
982
Barrel Culvert Flow
Channel Flow
Channel Crest
Barrel Invert
0
5
10
15
20
25
DISCHARGE IN CFS

PLATE D-3

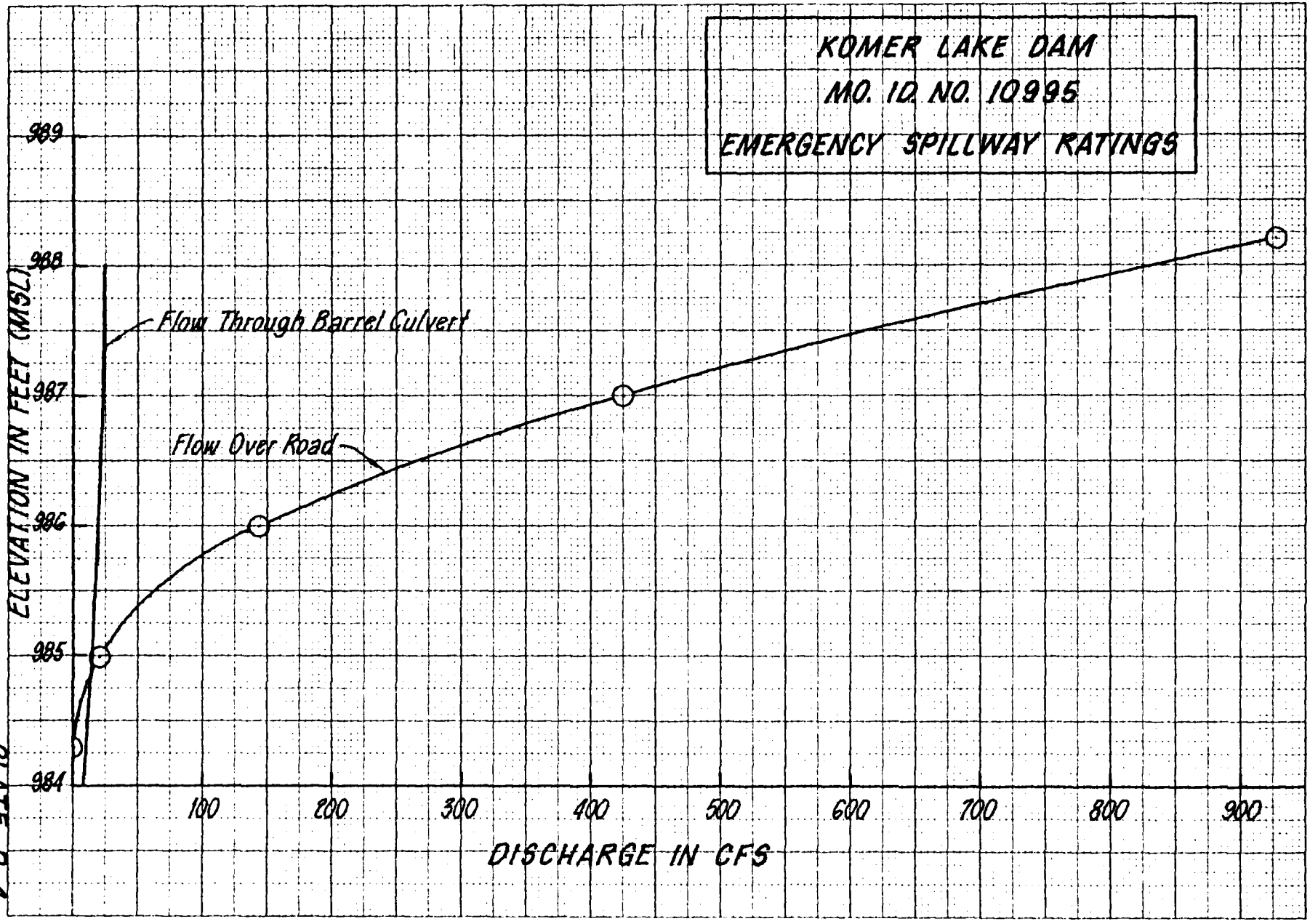


PLATE D-4

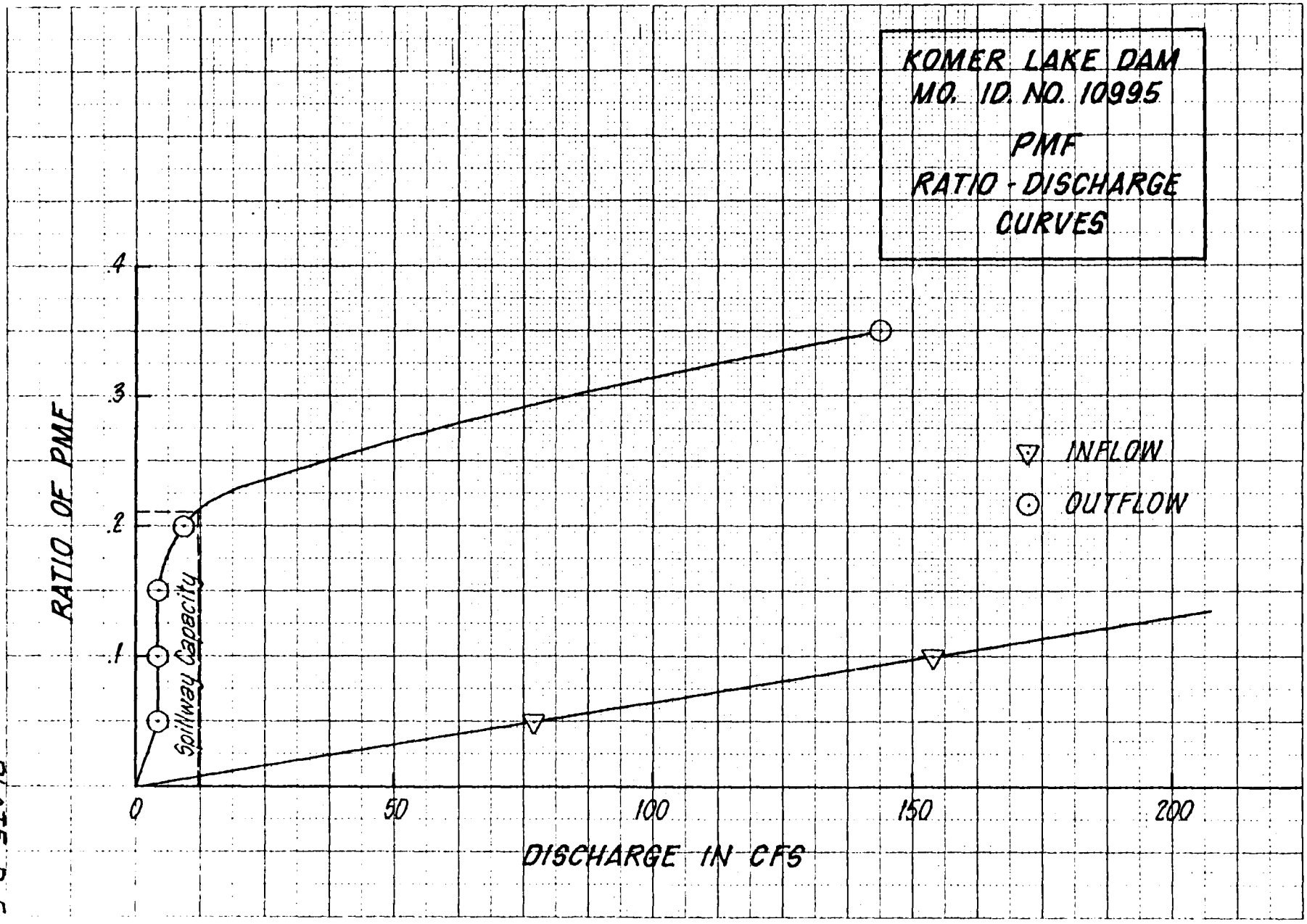


PLATE D-5

```
                    KOMER LAKE DAM MO ,D MO 10995
A2      SAFETY ANALYSIS OF DAM OVERTOPPING USING ASSIGNED FLOOD FREQUENCIES
A3              H & H ANALYSIS BY ROUTING PMF RATIOS THRU THE RESERVOIR
B 0002880000000000000005                    000000000000000000000003
B1000005
J 0000010000000800000001
J1000.0500000.1000000.1500000.2000000.3500000.5000000.75000001.0
K 00000000000001                    000000000000000000000001
K1      CALCULATION OF INFLOW HYDRO TO KOMER RESERVOIR
M 0000010000000020000.138       0000.138000001.0                    00000001
P 000000000024.200000102000001210000013O
T                                                       -1.0   -88.0
W2      00000.17
X 000000    -.0100000001
K 00000100000002                    000000020000000000000001
K1      ROUTED FLOWS THRU KOMER RESERVOIR
                        0000000100000001
Y                                                   -979.7      -1
Y1000001
Y40979.7000980.0000980.4000980.5000981.0000982.0000983.1000983.4000984.0000984.3
Y40985.0000986.0000987.0000988.0
Y5000000000000.2000000.7000003.9000003.9000004.0000004.0000009.0000001300000016
Y500003900000167000004520000085B
$A000000000001.8000002.3000005.0000009.6000012.6000016.3
$E000942000009500000096000000970000009800000098500000990
$$0979.7
$D0983.9000002.8000001.500000550
$L000000000000580000012800000198000003250000045000000500000005100000053000000550
$V0983.9000984.0000984.3000984.5000984.6000984.7000985.4000986.0000987.0000988.2
K 000099
A
A
A
A
A
```

PLATE D-6

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 80/07/15.
     TIME= 23.27.25.
```

KOMER LAKE DAM MO ID MO 10995
SAFETY ANALYSIS OF DAM OVERTOPPING USING ASSIGNED FLOOD FREQUENCIES
H & H ANALYSIS BY ROUTING PMF RATIOS THRU THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 8 LRTIO= 1

RTIOS= .05 .10 .15 .20 .35 .50 .75 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDRO TO KOMER RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000001	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.14	0.00	.14	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.20	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-88.00	0.00	0.00

CURVE NO = -88.00 WETNESS = -1.00 EFFECT CN = 88.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .17

RECESSION DATA
STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .17 VOL= 1.00

3%.	290.	298.	187.	94.	50.	26.	14.	7.	4.
2.	1.								

0 END-OF-PERIOD FLOW

PLATE D-7

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.05	145	.21	.20	.01	78.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.10	146	.21	.20	.01	118.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.21	.20	.01	158.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.21	.20	.01	184.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.21	.20	.01	197.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.21	.20	.01	204.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.21	.20	.01	208.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.21	.20	.01	211.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.21	.20	.01	212.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.21	.20	.01	213.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.21	.20	.01	214.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.21	.20	.00	214.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.25	.24	.01	218.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.25	.24	.01	230.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.15	159	.25	.24	.00	242.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.20	160	.25	.24	.00	250.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.25	161	.25	.24	.00	254.
1.01	1.30	18	.01	0.00	.01	0.	1.01	13.30	162	.25	.24	.00	256.
1.01	1.35	19	.01	0.00	.01	0.	1.01	13.35	163	.25	.24	.00	258.
1.01	1.40	20	.01	0.00	.01	0.	1.01	13.40	164	.25	.24	.00	258.
1.01	1.45	21	.01	0.00	.01	0.	1.01	13.45	165	.25	.24	.00	259.
1.01	1.50	22	.01	0.00	.01	0.	1.01	13.50	166	.25	.24	.00	259.
1.01	1.55	23	.01	.00	.01	0.	1.01	13.55	167	.25	.24	.00	260.
1.01	2.00	24	.01	.00	.01	0.	1.01	14.00	168	.25	.24	.00	260.
1.01	2.05	25	.01	.00	.01	0.	1.01	14.05	169	.31	.30	.00	266.
1.01	2.10	26	.01	.00	.01	0.	1.01	14.10	170	.31	.30	.00	284.
1.01	2.15	27	.01	.00	.01	0.	1.01	14.15	171	.31	.31	.00	302.
1.01	2.20	28	.01	.00	.01	1.	1.01	14.20	172	.31	.31	.00	313.
1.01	2.25	29	.01	.00	.01	1.	1.01	14.25	173	.31	.31	.00	319.
1.01	2.30	30	.01	.00	.01	1.	1.01	14.30	174	.31	.31	.00	323.
1.01	2.35	31	.01	.00	.01	1.	1.01	14.35	175	.31	.31	.00	324.
1.01	2.40	32	.01	.00	.01	1.	1.01	14.40	176	.31	.31	.00	325.
1.01	2.45	33	.01	.00	.01	2.	1.01	14.45	177	.31	.31	.00	326.
1.01	2.50	34	.01	.00	.01	2.	1.01	14.50	178	.31	.31	.00	326.
1.01	2.55	35	.01	.00	.01	2.	1.01	14.55	179	.31	.31	.00	327.
1.01	3.00	36	.01	.00	.01	2.	1.01	15.00	180	.31	.31	.00	327.
1.01	3.05	37	.01	.00	.01	2.	1.01	15.05	181	.19	.19	.00	315.
1.01	3.10	38	.01	.00	.01	2.	1.01	15.10	182	.38	.37	.00	299.
1.01	3.15	39	.01	.00	.01	3.	1.01	15.15	183	.38	.37	.00	317.
1.01	3.20	40	.01	.00	.01	3.	1.01	15.20	184	.56	.56	.00	368.
1.01	3.25	41	.01	.00	.01	3.	1.01	15.25	185	.66	.65	.00	454.
1.01	3.30	42	.01	.00	.01	3.	1.01	15.30	186	1.59	1.59	.01	638.
1.01	3.35	43	.01	.00	.01	3.	1.01	15.35	187	2.63	2.61	.01	1076.
1.01	3.40	44	.01	.00	.01	3.	1.01	15.40	188	1.03	1.03	.00	1538.
1.01	3.45	45	.01	.00	.01	4.	1.01	15.45	189	.66	.65	.00	1543.
1.01	3.50	46	.01	.00	.01	4.	1.01	15.50	190	.56	.56	.00	1243.
1.01	3.55	47	.01	.00	.01	4.	1.01	15.55	191	.38	.37	.00	939.
1.01	4.00	48	.01	.00	.01	4.	1.01	16.00	192	.38	.37	.00	718.
1.01	4.05	49	.01	.00	.01	4.	1.01	16.05	193	.29	.29	.00	564.
1.01	4.10	50	.01	.00	.01	4.	1.01	16.10	194	.29	.29	.00	456.
1.01	4.15	51	.01	.00	.01	4.	1.01	16.15	195	.29	.29	.00	380.
1.01	4.20	52	.01	.00	.01	4.	1.01	16.20	196	.29	.29	.00	349.
1.01	4.25	53	.01	.00	.01	5.	1.01	16.25	197	.29	.29	.00	329.
1.01	4.30	54	.01	.00	.01	5.	1.01	16.30	198	.29	.29	.00	317.
1.01	4.35	55	.01	.00	.01	5.	1.01	16.35	199	.29	.29	.00	311.
1.01	4.40	56	.01	.00	.01	5.	1.01	16.40	200	.29	.29	.00	309.
1.01	4.45	57	.01	.00	.01	5.	1.01	16.45	201	.29	.29	.00	308.
1.01	4.50	58	.01	.01	.01	5.	1.01	16.50	202	.29	.29	.00	307.
1.01	4.55	59	.01	.01	.01	5.	1.01	16.55	203	.29	.29	.00	307.
1.01	5.00	60	.01	.01	.01	5.	1.01	17.00	204	.29	.29	.00	307.

1.01	5.05	61	.01	.01	.01	5.	1.01	17.05	205	.23	.23	.00	301.
1.01	5.10	62	.01	.01	.01	6.	1.01	17.10	206	.23	.23	.00	283.
1.01	5.15	63	.01	.01	.01	6.	1.01	17.15	207	.23	.23	.00	265.
1.01	5.20	64	.01	.01	.01	6.	1.01	17.20	208	.23	.23	.00	253.
1.01	5.25	65	.01	.01	.01	6.	1.01	17.25	209	.23	.23	.00	248.
1.01	5.30	66	.01	.01	.01	6.	1.01	17.30	210	.23	.23	.00	245.
1.01	5.35	67	.01	.01	.01	6.	1.01	17.35	211	.23	.23	.00	243.
1.01	5.40	68	.01	.01	.01	6.	1.01	17.40	212	.23	.23	.00	242.
1.01	5.45	69	.01	.01	.01	6.	1.01	17.45	213	.23	.23	.00	242.
1.01	5.50	70	.01	.01	.01	6.	1.01	17.50	214	.23	.23	.00	241.
1.01	5.55	71	.01	.01	.01	6.	1.01	17.55	215	.23	.23	.00	241.
1.01	6.00	72	.01	.01	.01	6.	1.01	18.00	216	.23	.23	.00	241.
1.01	6.05	73	.06	.03	.03	9.	1.01	18.05	217	.02	.02	.00	221.
1.01	6.10	74	.06	.04	.03	17.	1.01	18.10	218	.02	.02	.00	161.
1.01	6.15	75	.06	.04	.03	26.	1.01	18.15	219	.02	.02	.00	99.
1.01	6.20	76	.06	.04	.02	33.	1.01	18.20	220	.02	.02	.00	61.
1.01	6.25	77	.06	.04	.02	37.	1.01	18.25	221	.02	.02	.00	41.
1.01	6.30	78	.06	.04	.02	40.	1.01	18.30	222	.02	.02	.00	31.
1.01	6.35	79	.06	.04	.02	42.	1.01	18.35	223	.02	.02	.00	25.
1.01	6.40	80	.06	.04	.02	44.	1.01	18.40	224	.02	.02	.00	22.
1.01	6.45	81	.06	.04	.02	45.	1.01	18.45	225	.02	.02	.00	21.
1.01	6.50	82	.06	.05	.02	46.	1.01	18.50	226	.02	.02	.00	20.
1.01	6.55	83	.06	.05	.02	48.	1.01	18.55	227	.02	.02	.00	20.
1.01	7.00	84	.06	.05	.02	49.	1.01	19.00	228	.02	.02	.00	19.
1.01	7.05	85	.06	.05	.02	50.	1.01	19.05	229	.02	.02	.00	19.
1.01	7.10	86	.06	.05	.01	50.	1.01	19.10	230	.02	.02	.00	19.
1.01	7.15	87	.06	.05	.01	51.	1.01	19.15	231	.02	.02	.00	19.
1.01	7.20	88	.06	.05	.01	52.	1.01	19.20	232	.02	.02	.00	19.
1.01	7.25	89	.06	.05	.01	53.	1.01	19.25	233	.02	.02	.00	19.
1.01	7.30	90	.06	.05	.01	53.	1.01	19.30	234	.02	.02	.00	19.
1.01	7.35	91	.06	.05	.01	54.	1.01	19.35	235	.02	.02	.00	19.
1.01	7.40	92	.06	.05	.01	55.	1.01	19.40	236	.02	.02	.00	19.
1.01	7.45	93	.06	.05	.01	55.	1.01	19.45	237	.02	.02	.00	19.
1.01	7.50	94	.06	.05	.01	56.	1.01	19.50	238	.02	.02	.00	19.
1.01	7.55	95	.06	.05	.01	56.	1.01	19.55	239	.02	.02	.00	19.
1.01	8.00	96	.06	.05	.01	57.	1.01	20.00	240	.02	.02	.00	19.
1.01	8.05	97	.06	.05	.01	57.	1.01	20.05	241	.02	.02	.00	19.
1.01	8.10	98	.06	.05	.01	57.	1.01	20.10	242	.02	.02	.00	19.
1.01	8.15	99	.06	.05	.01	58.	1.01	20.15	243	.02	.02	.00	19.
1.01	8.20	100	.06	.06	.01	58.	1.01	20.20	244	.02	.02	.00	19.
1.01	8.25	101	.06	.06	.01	59.	1.01	20.25	245	.02	.02	.00	19.
1.01	8.30	102	.06	.06	.01	59.	1.01	20.30	246	.02	.02	.00	19.
1.01	8.35	103	.06	.06	.01	59.	1.01	20.35	247	.02	.02	.00	19.
1.01	8.40	104	.06	.06	.01	60.	1.01	20.40	248	.02	.02	.00	19.
1.01	8.45	105	.06	.06	.01	60.	1.01	20.45	249	.02	.02	.00	19.
1.01	8.50	106	.06	.06	.01	60.	1.01	20.50	250	.02	.02	.00	19.
1.01	8.55	107	.06	.06	.01	60.	1.01	20.55	251	.02	.02	.00	19.
1.01	9.00	108	.06	.06	.01	61.	1.01	21.00	252	.02	.02	.00	19.
1.01	9.05	109	.06	.06	.01	61.	1.01	21.05	253	.02	.02	.00	19.
1.01	9.10	110	.06	.06	.01	61.	1.01	21.10	254	.02	.02	.00	19.
1.01	9.15	111	.06	.06	.01	61.	1.01	21.15	255	.02	.02	.00	19.
1.01	9.20	112	.06	.06	.01	61.	1.01	21.20	256	.02	.02	.00	19.
1.01	9.25	113	.06	.06	.01	62.	1.01	21.25	257	.02	.02	.00	19.
1.01	9.30	114	.06	.06	.01	62.	1.01	21.30	258	.02	.02	.00	19.
1.01	9.35	115	.06	.06	.01	62.	1.01	21.35	259	.02	.02	.00	19.
1.01	9.40	116	.06	.06	.01	62.	1.01	21.40	260	.02	.02	.00	19.
1.01	9.45	117	.06	.06	.01	62.	1.01	21.45	261	.02	.02	.00	19.
1.01	9.50	118	.06	.06	.01	63.	1.01	21.50	262	.02	.02	.00	19.
1.01	9.55	119	.06	.06	.00	63.	1.01	21.55	263	.02	.02	.00	19.
1.01	10.00	120	.06	.06	.00	63.	1.01	22.00	264	.02	.02	.00	19.
1.01	10.05	121	.06	.06	.00	63.	1.01	22.05	265	.02	.02	.00	19.
1.01	10.10	122	.06	.06	.00	63.	1.01	22.10	266	.02	.02	.00	19.

1.01	10.15	123	.06	.06	.00	63.	1.01	22.15	267	.02	.02	.00	19.
1.01	10.20	124	.06	.06	.00	63.	1.01	22.20	268	.02	.02	.00	19.
1.01	10.25	125	.06	.06	.00	63.	1.01	22.25	269	.02	.02	.00	19.
1.01	10.30	126	.06	.06	.00	64.	1.01	22.30	270	.02	.02	.00	19.
1.01	10.35	127	.06	.06	.00	64.	1.01	22.35	271	.02	.02	.00	19.
1.01	10.40	128	.06	.06	.00	64.	1.01	22.40	272	.02	.02	.00	19.
1.01	10.45	129	.06	.06	.00	64.	1.01	22.45	273	.02	.02	.00	19.
1.01	10.50	130	.06	.06	.00	64.	1.01	22.50	274	.02	.02	.00	19.
1.01	10.55	131	.06	.06	.00	64.	1.01	22.55	275	.02	.02	.00	19.
1.01	11.00	132	.06	.06	.00	64.	1.01	23.00	276	.02	.02	.00	19.
1.01	11.05	133	.06	.06	.00	64.	1.01	23.05	277	.02	.02	.00	19.
1.01	11.10	134	.06	.06	.00	64.	1.01	23.10	278	.02	.02	.00	19.
1.01	11.15	135	.06	.06	.00	64.	1.01	23.15	279	.02	.02	.00	19.
1.01	11.20	136	.06	.06	.00	65.	1.01	23.20	280	.02	.02	.00	19.
1.01	11.25	137	.06	.06	.00	65.	1.01	23.25	281	.02	.02	.00	19.
1.01	11.30	138	.06	.06	.00	65.	1.01	23.30	282	.02	.02	.00	19.
1.01	11.35	139	.06	.06	.00	65.	1.01	23.35	283	.02	.02	.00	19.
1.01	11.40	140	.06	.06	.00	65.	1.01	23.40	284	.02	.02	.00	19.
1.01	11.45	141	.06	.06	.00	65.	1.01	23.45	285	.02	.02	.00	19.
1.01	11.50	142	.06	.06	.00	65.	1.01	23.50	286	.02	.02	.00	19.
1.01	11.55	143	.06	.06	.00	65.	1.01	23.55	287	.02	.02	.00	19.
1.01	12.00	144	.06	.06	.00	65.	1.02	0.00	288	.02	.02	.00	19.
									SUM	31.46	29.88	1.58	31850.
										(799.)(	759.)(	40.)(	901.89)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1543.	360.	111.	111.	31862.
CMS	44.	10.	3.	3.	902.
INCHES		24.24	29.83	29.83	29.83
MM		615.60	757.69	757.69	757.69
AC-FT		178.	219.	219.	219.
THOUS CU M		220.	271.	271.	271.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	77.	18.	6.	6.	1593.
CMS	2.	1.	0.	0.	45.
INCHES		1.21	1.49	1.49	1.49
MM		30.78	37.88	37.88	37.88
AC-FT		9.	11.	11.	11.
THOUS CU M		11.	14.	14.	14.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	154.	36.	11.	11.	3186.
CMS	4.	1.	0.	0.	90.
INCHES		2.42	2.98	2.98	2.98
MM		61.56	75.77	75.77	75.77
AC-FT		18.	22.	22.	22.
THOUS CU M		22.	27.	27.	27.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	231.	54.	17.	17.	4779.
CMS	7.	2.	0.	0.	135.
INCHES		3.64	4.47	4.47	4.47
MM		92.34	113.65	113.65	113.65
AC-FT		27.	33.	33.	33.
THOUS CU M		33.	41.	41.	41.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	309.	72.	22.	22.	6372.
CMS	9.	2.	1.	1.	180.
INCHES		4.85	5.97	5.97	5.97
MM		123.12	151.54	151.54	151.54
AC-FT		36.	44.	44.	44.
THOUS CU M		44.	54.	54.	54.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	540.	126.	39.	39.	11152.
CMS	15.	4.	1.	1.	316.
INCHES		8.48	10.44	10.44	10.44
MM		215.46	265.19	265.19	265.19
AC-FT		62.	77.	77.	77.
THOUS CU M		77.	95.	95.	95.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 6 [1/2 PMF]

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	771.	180.	55.	55.	15931.
CMS	22.	5.	2.	2.	451.
INCHES		12.12	14.92	14.92	14.92
MM		307.80	378.84	378.84	378.84
AC-FT		89.	110.	110.	110.
THOUS CU M		110.	135.	135.	135.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1157.	270.	83.	83.	23897.
CMS	33.	8.	2.	2.	677.
INCHES		18.18	22.37	22.37	22.37
MM		461.70	568.26	568.26	568.26
AC-FT		134.	165.	165.	165.
THOUS CU M		165.	203.	203.	203.

HYDROGRAPH AT STA000001 FOR PLAN 1, RTIO 8 [PMF]

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1543.	360.	111.	111.	31862.

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                   CMS      44.      10.       3.        3.          902.
                INCHES              24.24    29.83     29.83        29.83
                    MM             615.60   757.69    757.69       757.69
                 AC-FT               178.     219.      219.         219.
             THOUS CU M              220.     271.      271.         271.



     **********          **********          **********          **********          **********

                                       HYDROGRAPH ROUTING

                ROUTED FLOWS THRU KOMER RESERVOIR

                               ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                              000002        1        0        0        2        0        1        0        0
                                                     ROUTING DATA
                       QLOSS    CLOSS      AVG     IRES    ISAME     IOPT     IPMP              LSTR
                         0.0    0.000     0.00        1        1        0        0                 0

                               NSTPS    NSTDL      LAG    AMSKK        X      TSK    STORA   ISPRAT
                                   1        0        0    0.000    0.000    0.000    -980.       -1

   STAGE       979.70      980.00      980.40      980.50      981.00      982.00      983.10      983.40      984.00      984.30
               985.00      986.00      987.00      988.00

    FLOW         0.00         .20         .70        3.90        3.90        4.00        4.00        9.00       13.00       16.00
                39.00      167.00      452.00      858.00

  SURFACE AREA=       0.        2.        2.        5.       10.       13.       16.

     CAPACITY=        0.        5.       25.       61.      133.      188.      260.

    ELEVATION=      942.      950.      960.      970.      980.      985.      990.

                              CREL    SPWID     COQW     EXPW    ELEVL     COQL    CAREA     EXPL
                             979.7      0.0      0.0      0.0      0.0      0.0      0.0      0.0

                                                       DAM DATA
                                              TOPEL     COQD     EXPD   DAMWID
                                              983.9      2.8      1.5     550.

    CREST LENGTH        0.       58.      128.      198.      325.      450.      500.      510.      530.      550.
    AT OR BELOW
    ELEVATION        983.9     984.0     984.3     984.5     984.6     984.7     985.4     986.0     987.0     988.2

                                        STATION 000002, PLAN 1, RATIO 1

                                    END-OF-PERIOD HYDROGRAPH ORDINATES

                                                 OUTFLOW
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
            0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
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                          STATION 000002, PLAN 1, RATIO 6
                          END-OF-PERIOD HYDROGRAPH ORDINATES
                                       OUTFLOW
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
    0.       1.       1.       1.       1.       1.       1.       1.       1.       1.
    2.       3.       3.       4.       4.       4.       4.       4.       4.       4.
    4.       4.       4.       4.       4.       4.       4.       4.       4.       4.
    4.       4.       4.       4.       4.       4.       4.       4.       4.       4.
    4.       4.       4.       4.       4.       4.       4.       4.       4.       4.
    4.       4.       4.       4.       4.       4.       4.       4.       4.       4.
    4.       4.       4.       4.       4.       4.       4.       4.       4.       4.
    4.       4.       4.       6.       7.       9.       9.      10.      11.      11.
   12.      12.      14.      22.      37.      67.     140.     319.     556.     639.
  585.     488.     399.     328.     276.     239.     214.     197.     185.     177.
  170.     166.     163.     160.     158.     155.     151.     146.     141.     137.
  133.     131.     128.     127.     125.     124.     122.     117.     106.      93.
   80.      70.      62.      55.      50.      45.      41.      38.      36.      33.
   31.      29.      28.      26.      25.      24.      23.      22.      21.      21.
   20.      19.      19.      18.      18.      18.      17.      17.      17.      16.
   16.      16.      15.      15.      15.      15.      15.      15.      14.      14.
   14.      14.      14.      14.      14.      14.      14.      14.      13.      13.
   13.      13.      13.      13.      13.      13.      13.      13.      13.      13.
   13.      13.      13.      13.      13.      13.      13.      13.

                                       STORAGE
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
  130.     130.     130.     130.     130.     130.     130.     130.     130.     130.
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  163.     164.     165.     166.     167.     168.     169.     170.     172.     173.
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1/2 PMF

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      175.      175.      175.      175.      175.      175.      175.      175.

                                              STAGE
     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7
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     980.0     980.1     980.1     980.1     980.1     980.1     980.2     980.2     980.2     980.2
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     983.9     983.9     983.9     983.9     983.9     983.9     983.9     983.9

PEAK OUTFLOW IS       539. AT TIME  15.83 HOURS

                              PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
                    CFS       639.      120.        33.        33.          9433.
                    CMS        18.        3.         1.         1.           267.
                 INCHES                 8.09       8.83       8.83           8.83
                     MM               205.38     224.32     224.32         224.32
                  AC-FT                  59.        65.        65.            65.
             THOUS CU M                  73.        80.        80.            80.
```


4.45 571
4.50 581
4.55 591
4.00 601
5.05 611
5.10 621
5.15 631
5.20 641
5.25 651
5.30 661
5.35 671
5.40 681
5.45 691
5.50 701
5.55 711
6.00 721
6.05 731
6.10 7401
6.15 7501
6.20 760
6.25 770
6.30 780
6.35 790
6.40 800
6.45 810
6.50 820
6.55 830
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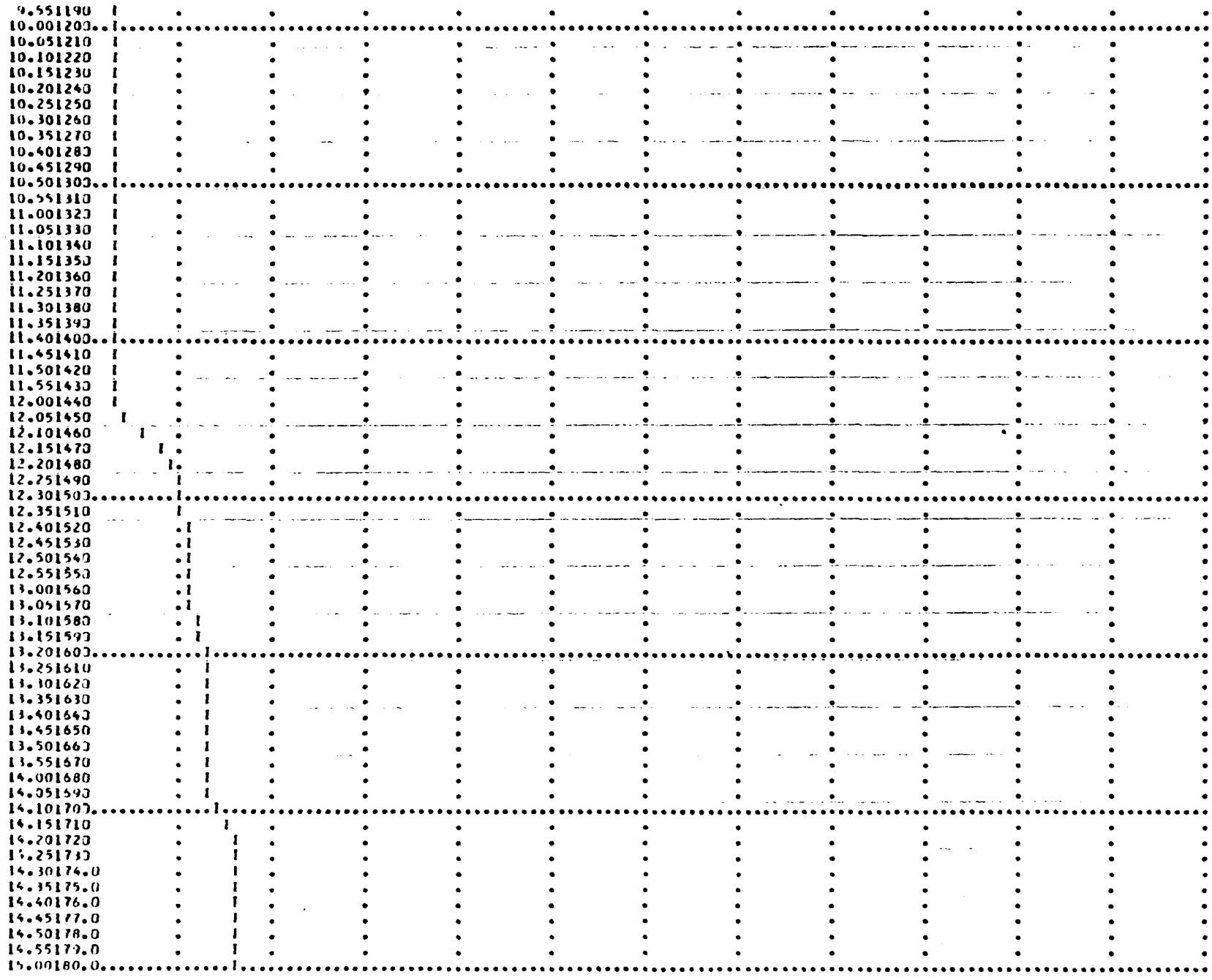
PLATE D-15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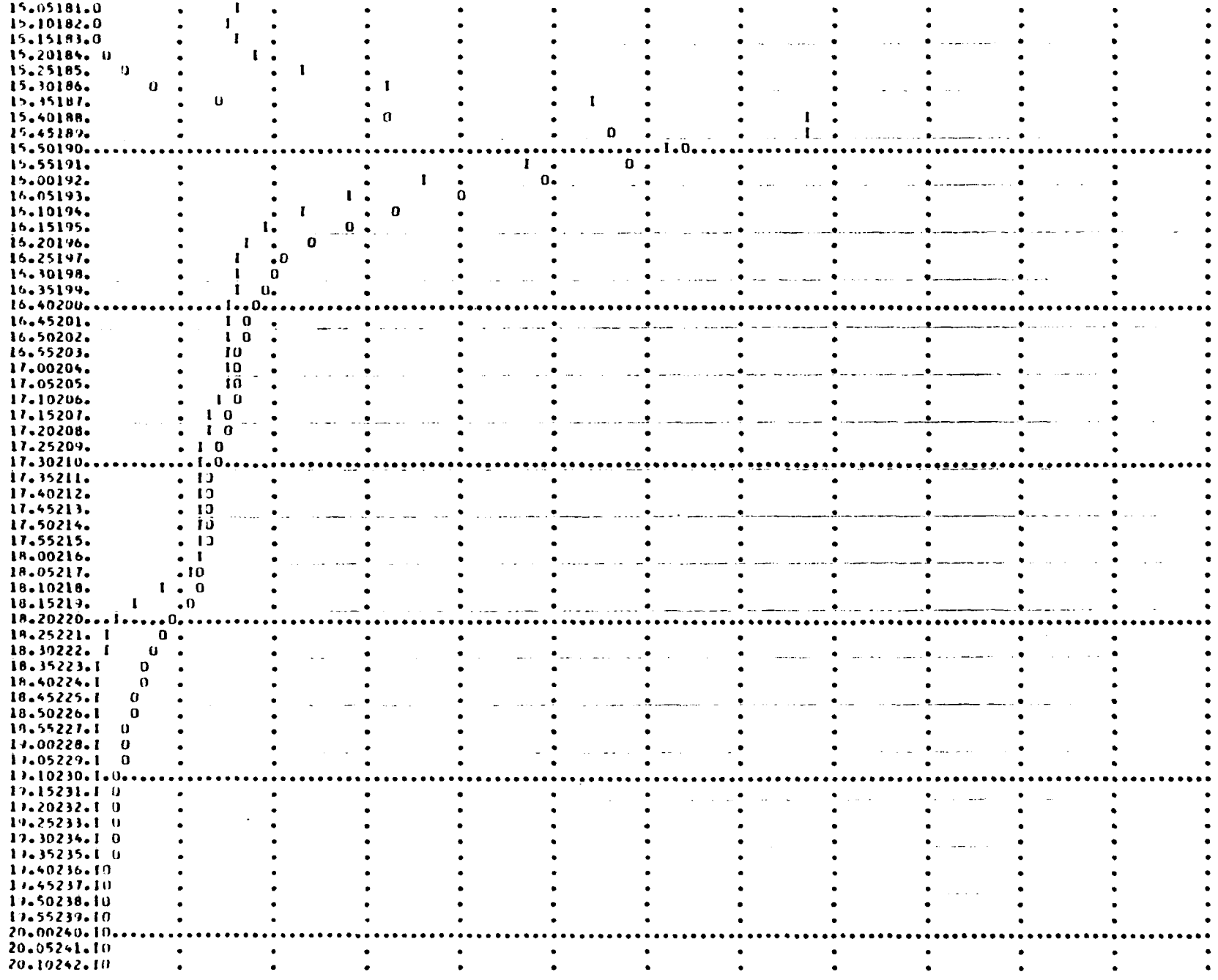
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PLATE D-17

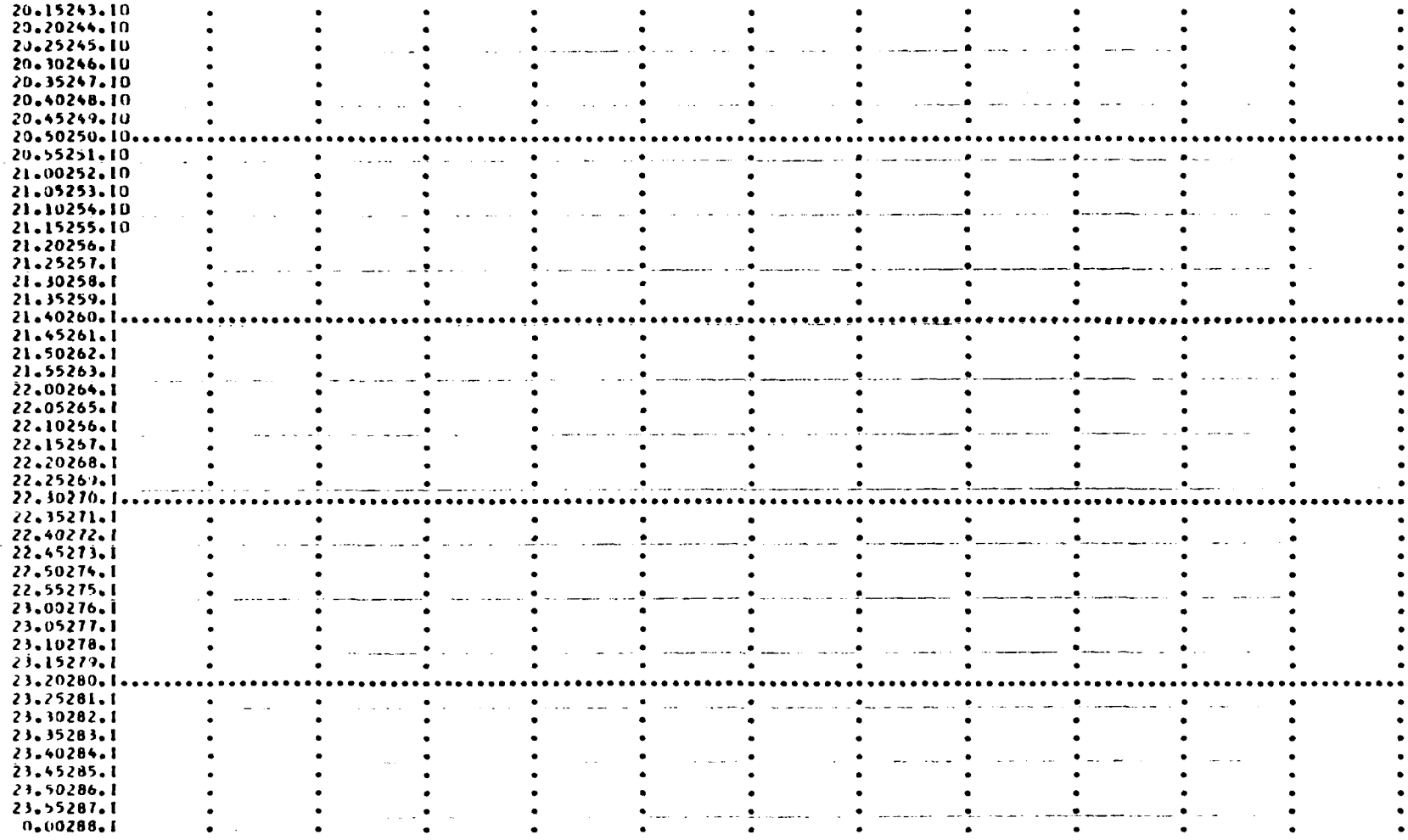
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PLATE D-18

OVN

```
                         STATION 000002, PLAN 1, RATIO 8  PMF

                         END-OF-PERIOD HYDROGRAPH ORDINATES

                                     OUTFLOW
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
     0.        0.        0.        0.        0.        0.        0.        1.        1.        1.
     1.        1.        2.        3.        4.        4.        4.        4.        4.        4.
     4.        4.        4.        4.        4.        4.        4.        4.        4.        4.
     4.        4.        4.        4.        4.        4.        4.        4.        4.        4.
     4.        4.        4.        4.        4.        4.        4.        4.        4.        4.
     4.        4.        4.        4.        4.        4.        4.        4.        4.        4.
     4.        4.        4.        4.        4.        4.        4.        4.        4.        4.
     4.        5.        7.        9.       10.       11.       11.       12.       17.       33.
    58.       91.      126.      159.      187.      211.      227.      239.      248.      258.
   272.      286.      299.      309.      315.      320.      322.      324.      325.      326.
   324.      316.      312.      326.      366.      459.      689.     1107.     1424.     1401.
  1173.      931.      738.      598.      498.      428.      382.      354.      335.      324.
   317.      312.      310.      309.      307.      300.      289.      277.      266.      258.
   253.      249.      246.      244.      243.      243.      238.      222.      191.      159.
   132.      110.       93.       80.       70.       63.       57.       53.       49.       45.
    43.       40.       38.       36.       35.       33.       32.       31.       30.       29.
    28.       28.       27.       26.       26.       25.       25.       25.       24.       24.
    24.       23.       23.       23.       23.       22.       22.       22.       22.       22.
    22.       21.       21.       21.       21.       21.       21.       21.       21.       21.
    21.       20.       20.       20.       20.       20.       20.       20.       20.       20.
    20.       20.       20.       20.       20.       20.       20.       20.

                                     STORAGE
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      176.      176.      176.      176.      176.      176.      176.      176.

                                          STAGE
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     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7
     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7
     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7
     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7     979.7
     979.7     979.7     979.8     979.8     979.8     979.8     979.8     979.8     979.8     979.8
     979.8     979.8     979.8     979.8     979.8     979.8     979.8     979.8     979.8     979.8
     979.8     979.8     979.8     979.8     979.9     979.9     979.9     979.9     980.0     980.0
     980.0     980.1     980.1     980.1     980.2     980.2     980.2     980.3     980.3     980.3
     980.4     980.4     980.5     980.5     980.5     980.6     980.6     980.6     980.7     980.7
     980.7     980.8     980.8     980.9     980.9     980.9     981.0     981.0     981.0     981.1
     981.1     981.2     981.2     981.2     981.3     981.3     981.4     981.4     981.4     981.5
     981.5     981.6     981.6     981.6     981.7     981.7     981.7     981.8     981.8     981.9
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     982.3     982.3     982.4     982.4     982.4     982.5     982.6     982.7     982.8     982.9
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     984.3     984.4     984.5     984.5     984.6     984.6     984.6     984.6     984.6     984.7
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     984.7     984.6     984.6     984.6     984.6     984.6     984.6     984.6     984.6     984.5
     984.5     984.4     984.4     984.3     984.3     984.3     984.3     984.2     984.2     984.2
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     984.1     984.1     984.1     984.1     984.1     984.1     984.1     984.1     984.1     984.1
     984.1     984.1     984.1     984.1     984.1     984.1     984.1     984.1

PEAK OUTFLOW IS      1424. AT TIME  15.75 HOURS

                             PEAK    6-HOUR   24-HOUR   72-HOUR   TOTAL VOLUME
                     CFS    1424.      326.       87.       87.         25119.
                     CMS      40.        9.        2.        2.           711.
                  INCHES              21.95     23.52     23.52          23.52
                      MM             557.65    597.33    597.33         597.33
                   AC-FT               162.      173.      173.           173.
              THOUS CU M               199.      213.      213.           213.
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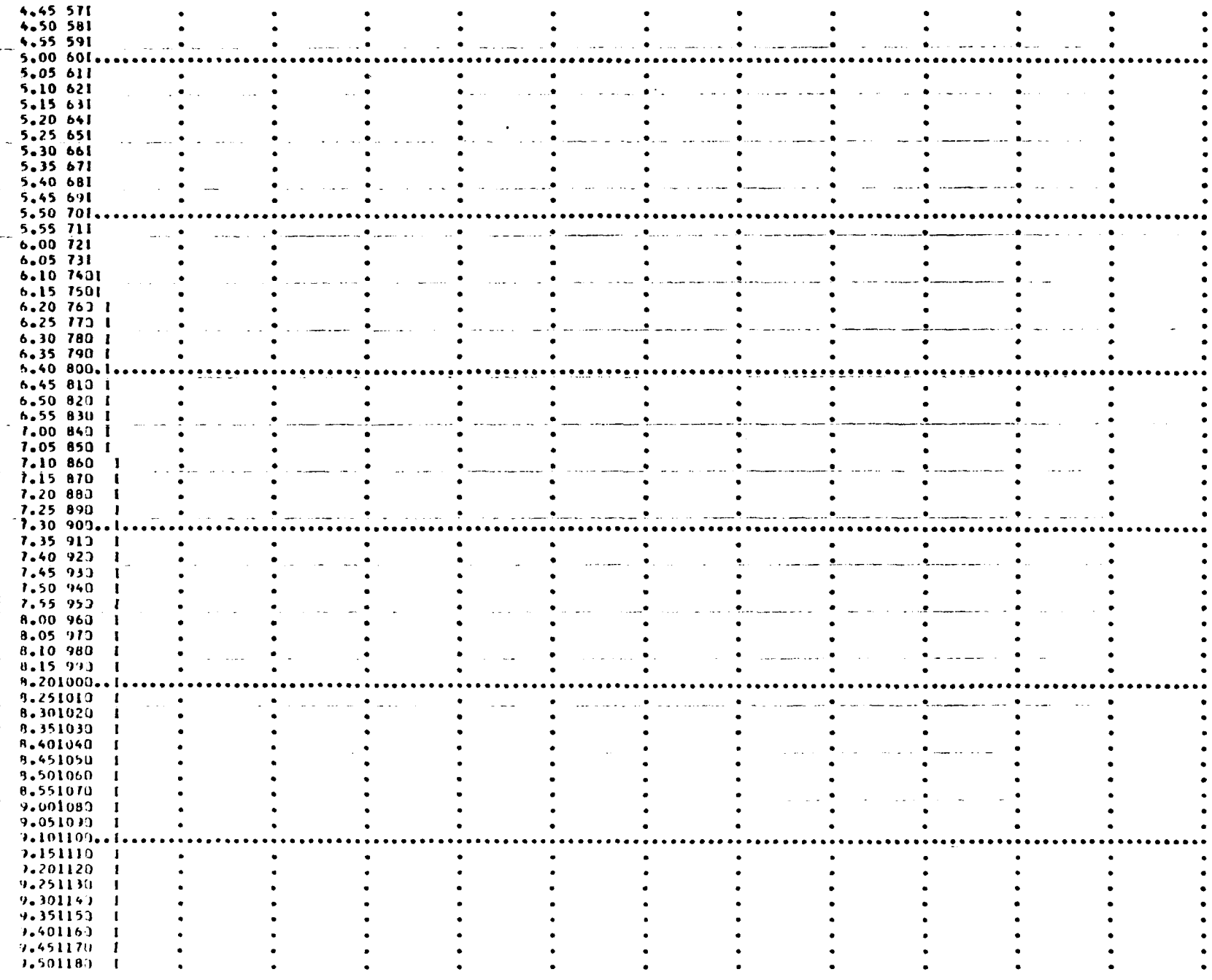
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PLATE D-21

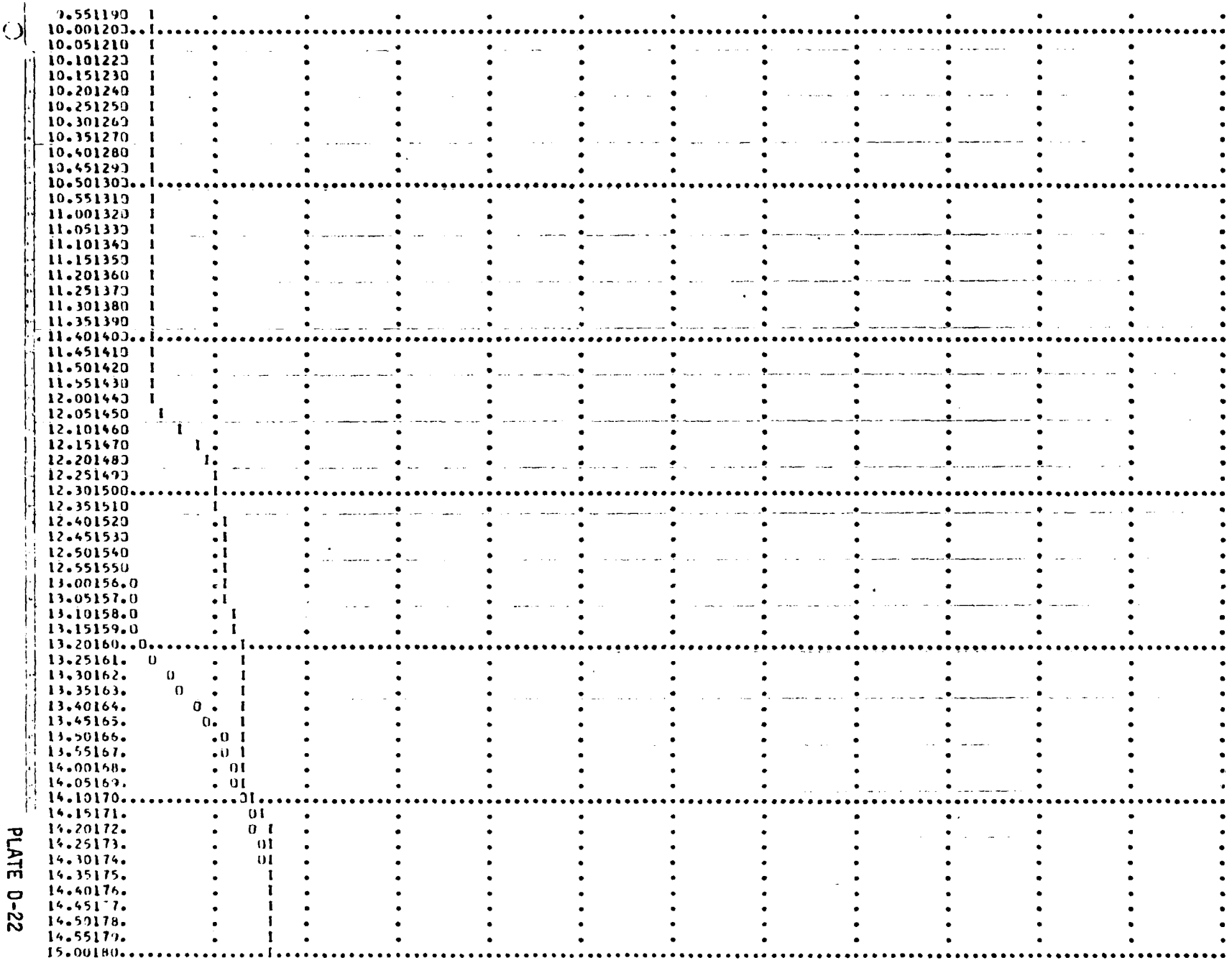
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PLATE D-22

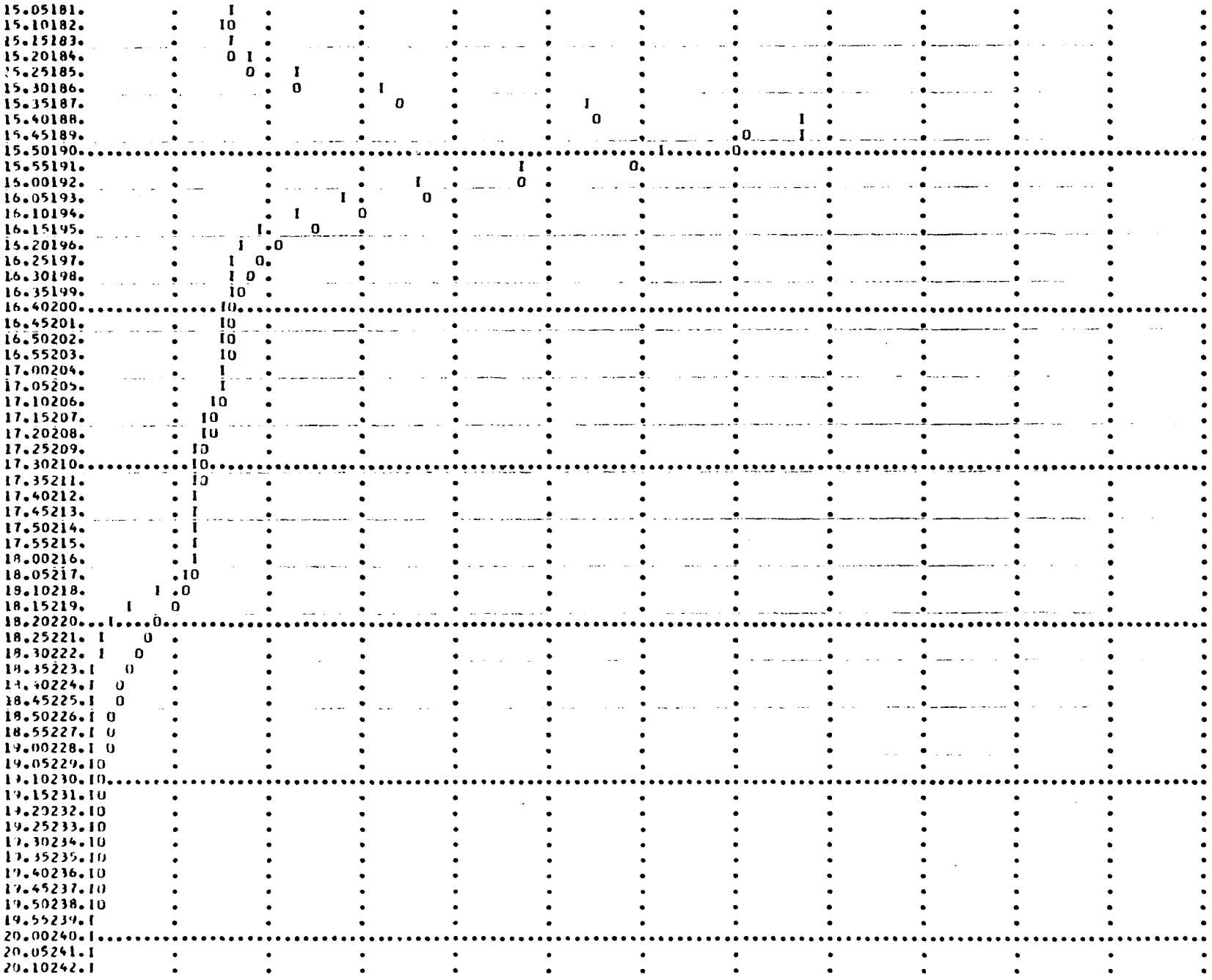
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PLATE D-23

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .05	RATIO 2 .10	RATIO 3 .15	RATIO 4 .20	RATIO 5 .35	RATIO 6 .50	RATIO 7 .75	RATIO 8 1.00
HYDROGRAPH AT	000001	.14	1	77.	154.	231.	309.	540.	771.	1157.	1543.
	(	.36)	(	2.18)(	4.37)(	6.55)(	8.74)(	15.29)(	21.84)(	32.76)(	43.69)(
ROUTED TO	000002	.14	1	4.	4.	4.	9.	144.	639.	1042.	1424.
	(	.36)	(	.11)(	.11)(	.11)(	.27)(	4.06)(	18.08)(	29.52)(	40.33)(

PLATE D-24

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	979.70	979.70	983.90
STORAGE	130.	130.	175.
OUTFLOW	0.	0.	12.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	980.69	0.00	139.	4.	0.00	16.08	0.00
.10	981.66	0.00	149.	4.	0.00	18.42	0.00
.15	982.60	0.00	160.	4.	0.00	16.25	0.00
.20	983.46	0.00	169.	9.	0.00	18.42	0.00
.35	984.49	.59	182.	144.	7.08	16.25	0.00
.50	984.96	1.06	187.	639.	8.92	15.83	0.00
.75	985.18	1.28	190.	1042.	10.08	15.83	0.00
1.00	985.36	1.46	193.	1424.	10.83	15.75	0.00